



# FLORA OF OMAN

VOLUME I



S.A. Ghazanfar

Cover illustration:

*Maerua crassifolia* (Capparaceae); photo S.A. Ghazanfar

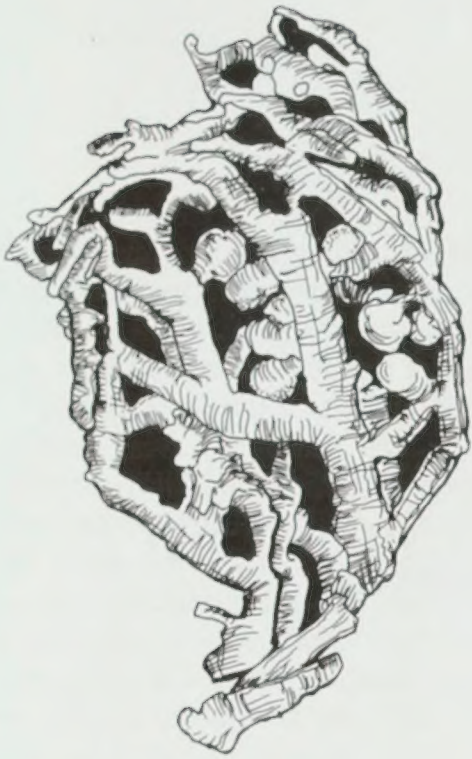
Illustration page i:

Dried plant of *Anastatica hierochuntica* (Brassicaceae)

Drawn by S.A. Ghazanfar



08 AUG. 2003



Shahina A. Ghazanfar

# Flora of the Sultanate of Oman

Volume 1  
Piperaceae - Primulaceae

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Shahina A. Ghazanfar

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Illustration page i: dried plant of *Anastatica hierochuntica* (Brassicaceae); drawn by S.A. Ghazanfar

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## Foreword

At last - the Sultanate has the Flora it both needs and deserves! Undergoing rapid economic and population growth, Oman now has the first comprehensive account of the plants that are an integral part of its natural and cultural heritage. A variety of important and immediate roles can easily be found for the Flora.

Firstly, it is the source of the most fundamental information about Oman's plants - their names, what they look like and where they occur. Anyone monitoring or concerned about changes in the country's environment now has the basic wherewithal with which to work. Secondly, particularly through the distribution maps, it sets very clear challenges for more 'dots' for every species to be found. The combined efforts of the relatively few, mainly expatriate, people who have studied Oman's plants can, after all, be just the starting point for an intimate knowledge about them. For knowledge to increase, a new generation of botanists must be encouraged and trained, and be given the awareness that their own eventual expertise has a part to play in Oman's future. The Flora will surely be an inspiration to them. As elsewhere, the sort and pace of changes taking place in Oman will also lead searches in other directions, for wild plants are not just the green clothing of the country and the sustenance of livestock. Many of them, for example, have provided direct material support for human life in the form of medicines or potions. Initiatives to capture, before they have gone, all the traditional uses and knowledge about these plants may also be stimulated by this Flora. Unlike many counterparts, it contains an abundance of vernacular names that workers in other disciplines can now match up to scientific ones. The IUCN Red List categories will equally be useful to policy makers needing, for example, instant assessments of the possible outcomes of construction schemes. In short, the Flora should be on the shelf of anyone in Oman involved with education, conservation, and development! And numerous researchers and enthusiasts all round the world will now be able to fill their own book shelf gap for this floristic crossroad of Africa and Asia on the edge of the Indian Ocean.

There is no one better qualified to write the Flora of the Sultanate of Oman than Dr Shahina Ghazanfar. Already well qualified and experienced in field botany after work in Pakistan and West Africa, she spent 12 years teaching botany at Sultan Qaboos University and travelling and collecting all round this country. And what a fascinating, beautiful and surprisingly varied country it is! Oman may not have a huge number of species, but who could fail to wonder at some of its great botanical spectacles like the fog-fed luxuriance of Dhofar and Jebel Akhdhar's juniper woodland? And what history could possibly be more fabled than that of its frankincense? No one has written as much about the plants of Oman as Dr Ghazanfar. She has discovered new species, found new localities, analysed and explained their occurrence, and investigated their role in human lives - and managed to publish it all for many an audience wanting to know more. With this in mind, I hope that in a few years time the highest accolade, and sign of success, of this Flora will be a second and much-expanded edition - but this time in Arabic too!

Hew Prendergast  
Curator, Centre for Economic Botany,  
Royal Botanic Gardens, Kew



## Illustrations

Colour photographs, when available, are referred to as 'plates' after the species descriptions. They are assembled on the CD-ROM in the inside of the cover; access to photographs is through three indices: plate numbers in text, families, and genera.

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# Contents

Foreword	iii
Acknowledgements	vi
Preface	vii
Abbreviations and Transliteration	viii
Introduction to vegetation, biogeography and conservation	1
Plant Families	11-170
Families with only cultivated species	
Caricaceae, Casuarinaceae, Juglandaceae, Muntingiaceae	171
Distribution Maps	173
Bibliography	249
Index	255

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Last but not least many thanks to Martin Fisher for his encouragement, and help with the format, and layout of the distribution maps.



## Preface

My work on the Flora of Oman began in 1987 when I started teaching at Sultan Qaboos University in Oman. The absence of a regional flora, combined with my own interest in the vegetation and flora of South West Asia, inspired me to work towards a descriptive flora of the country. This volume, the first of four, includes 42 families of flowering plants (38 native, 4 cultivated), and describes 310 taxa in 155 genera, following Cronquist's (1981) system of classification. For the treatment of each family, keys are provided to genera as well as to all species within a genus. Species descriptions are concise and include notes on distribution, habitat, flowering and fruiting times, conservation status, and any uses that the species may have. Details of type specimens are given only for those species for which the material originates from Oman; where type material originates from elsewhere on the Arabian Peninsula, the collector's name and number and the herbarium or herbaria where the type is located is given. Relevant synonyms are included for all species. Vernacular names, where known (including those in Jibbālī and Ḥarsūsī, the languages spoken in Dhofar (accepted spelling, correctly Zūfar) and the Jiddat al Ḥarasīs respectively), are given. Family or generic descriptions are not provided as these are available in several excellent publications to which reference is made under each family heading. An introduction to the history of botanical collection, vegetation, biogeography and conservation of the flora of Oman is given at the beginning, and a bibliography that includes the regional floras for the Arabian Peninsula is given at the end of the volume. Key references for the study of the vegetation and biogeography of Oman and Arabia include Fisher, Ghazanfar & Spalton (1999), Ghazanfar & Fisher (1998), and Miller & Morris (1988). Collenette (1999) illustrates many species in colour that are also found in Oman.

I have included distribution maps for all described species. These were prepared from collection data of localities taken from herbarium labels and from my field records. A dot represents the presence of a species in 25×25 km on a 100×100 km UTM grid on the map. Localities and their geographical coordinates are taken from the 100,000 scale National Survey maps of the country and the Gazetteer of Oman (Hourani & Heyda 1983). To facilitate identification of localities and vegetation zones mentioned in text, a map of Oman is included in the Introduction.

Photographs of most of the species included in this volume have been scanned and prepared as a CD. Upon completion of the four volumes I intend to make the complete Flora, and an interactive key to the families and species available in electronic format.

For those interested in the flora and vegetation of Oman I hope this volume will provide a useful guide to the identification of the species that are covered, and inspire an interest to record and collect additional distribution data for the species. It is only through fieldwork that we can gather information to improve our knowledge of the flora, vegetation, and biogeography of Oman.

This first volume of the Flora of Oman is dedicated to my children Tipu, Ali, and Zomo, with whom I have enjoyed many botanical excursions throughout Oman.

Shahina A. Ghazanfar  
Royal Botanic Gardens, Kew



## Abbreviations and Transliteration

Standard botanical abbreviations of Latin words used in text are listed below.

aff.	affinis: akin to
auct.	auctorum: of authors
c.	circa: about
in sched.	in schedula: on herbarium label or sheet
loc. cit.	loco citato: on the page previously cited
nom.	nomen: name
nom. conserv.	nomen conservandum: conserved name
nom. illegit.	nomen illegitimum: illegitimate name
nom. nud.	nomen nudum: name unaccompanied by a description
n.v.	non vidi: not seen
op. cit.	opere citato: in the work previously cited
p.p.	pro parte: in part
s.n.	sine numero: without number
s.l.	sensu lato: in a broad sense
s.str.	sensu stricto: in the strict sense

Arabic, Harsūsī and Jibbālī names are transliterated using the BGN/PCGN 1956 System (US Board on Geographical Names and the Permanent Committee on Geographical Names for British Official Use).

	Arabic	Romanization		Arabic	Romanization
Alif	ا	a	Dād	ض	ḍ
Ba	ب	b	Ṭa	ط	ṭ
Ta	ت	t	Za	ظ	ẓ
Tha	ث	th	‘Ayn	ع	‘
Jīm	ج	j	Ghayn	غ	gh
Ha	ح	h	Fa	ف	f
Kha	خ	kh	Qaf	ق	q
Da	د	d	Kaf	ك	k
Dha	ذ	dh	Lam	ل	l
Rā	ر	r	Mīm	م	m
Zā	ز	z	Nūn	ن	n
Sīn	س	s	Ha	هـ	h
Shīn	ش	sh	Waw	و	w
Sad	ص	ṣ	Ya	ي	y



# Introduction

Geological history and the influence of past climates have played a major role in shaping the composition and structure of the flora of Oman, and the present day flora contains derivatives of both Asian and African floristic elements. Isolation subsequent to the nearly complete separation of Arabia from Africa, the influence of climatic changes from the Miocene onwards (by which time most of peninsular Arabia had finally become dry land), and migration from Asia across the occasionally dry Arabian Gulf, have resulted in the evolution and divergence of several species groups in the present flora. A brief account of the history of the botanical exploration in Oman, and the vegetation, biogeography and conservation of the flora is given here. This account is adapted from Ghazanfar (1999b).

## History of Botanical Exploration

The first botanical excursion to Oman was made by Pierre Remi Martin Aucher-Eloy, a French plant collector, in March and April 1838. He travelled on foot and donkey over Jebel Akhdhar, Wuning Nakhil, Saiq, Wadi Bani Habib, Nizwa and Birkat al Mauz. He collected about 220 plant specimens that with his collections from other parts of Arabia and Iran were described and cited in *Flora Orientalis* (Boissier 1867–1888), which is still a standard reference for the plants of South-west Asia. Many of the plants that Aucher-Eloy collected from the northern mountains were new species and were given the specific epithets *mascatenis* and *aucheriana*, indicating respectively their geographic location and honouring their collector (Ghazanfar 1996a, Jaubert 1843).

In the latter half of the 19th and the early 20th centuries various travellers and plant collectors visited Oman, in particular the southern region of Dhofar. J.E.N. Bornmuller (coll. 1893), J.T. Bent and W. Lunt (coll. 1894–95), P.Z. Cox (coll. 1907), J. Fernandez (coll. 1925–26), R. Thomas (coll. 1927–37), D.F. Vesey Fitzgerald (coll. 1936, 1943–48) and W. Thesiger (coll. 1945–50, 1977) made important additions to the then little known flora of the country. The most comprehensive collections, however, were made from the 1970s onwards (Ghazanfar 1992a, Miller *et al.* 1982, Wickens 1982), with important contributions by J. Mandaville (coll. 1972, 1975, 1976, 1979), M.D. Gallagher (coll. 1973–98), A. Radcliffe-Smith (coll. 1976, 1977, 1980), R.P. Whitcombe (coll. 1977–80), A.G. Miller (coll. 1979, 1984, 1985, 1989, 1993), J.R. Edmondson (coll. 1980), J.R. Maconochie (coll. 1982), I. McLeish (coll. 1984–1994) and S.A. Ghazanfar (coll. 1987–2002).

Early collections from Oman were distributed to major herbaria in Europe, but after the establishment of the National Herbarium at the Oman Natural History Museum in 1981, duplicate material was retained there. The first set of c. 800 duplicates came from a country-wide rangeland survey (Anon. 1982). The National Herbarium now houses more than 15,000 specimens, and has received the duplicates of earlier collectors, including some of the specimens collected by Vesey-Fitzgerald in 1948. Only a few holotypes and isotypes are present, but most specimens have been authenticated.

## Floristics and Vegetation

A total of 1,208 species of vascular plants are presently known from Oman, of which 1,182 are angiosperms, comprising 568 genera in 119 families. 4 species are gymnosperms and 22 species are vascular cryptogams. In the angiosperm families, Poaceae (201 spp.), Asteraceae (c. 98 spp.), Fabaceae (81 spp.), Euphorbiaceae (39 spp.) and Scrophulariaceae (38 spp.) have the

most species. There are 39 families represented by only one species, 372 monospecific genera, two genera with >20 species and 14 genera with >10 species (Ghazanfar 1992b). The areas with the highest species richness are the northern and southern mountains, with the most species in Dhofar, where c. 72% of the total species can be found, and with c. 5% of the total flora restricted to that area. The northern mountains contain c. 60% of the total species, and the central plains and deserts <25% (Ghazanfar 1992b).

A little more than half of the species are annuals, the flowering of which is irregular from year to year depending on the timing and amount of rainfall, but generally occurring from February to April in the north and from August to November in the south (Ghazanfar 1997). In the northern and central regions the perennial species generally flower in the winter and early spring, from January to April in the northern foothills and plains and, from February to early June in the northern mountains. In Dhofar flowering occurs mostly from September to November, following the cessation of the summer south-west monsoon.

## Vegetation

The delimitation and description of the plant communities and associations of the vegetation of Oman have been described by Frev & Kürschner (1986), Ghazanfar (1991, 1995, 1999), Ghazanfar & Rappenhöner (1994), Mandaville (1977), Munton (1988), and Sale (1980). The vegetation can be classified into nine broad types (modified after Ghazanfar 1991a) as follows.

### 1. Northern Mountain Vegetation

Vegetation of the northern Hajar mountains, Musandam mountains and wadis. There is a marked altitudinal zonation with species richness greatest at 1,000–1,500 m (Ghazanfar 1991b). Four altitudinal zones have been recognized: (1) The *Acacia-Rhazya-Fagonia* zone at 650–1,000 m is typical of the gravel plains and foothills and includes trees and large and small species of shrubs. The natural vegetation is largely altered through over-grazing, now dominated by unpalatable species (*Rhazya stricta*, *Fagonia indica*) in this zone. *Acacia tortilis* is the most abundant tree, with associated species such as *Maerua crassifolia* and *Lycium shawii*; a few species characteristic of seasonally flowing wadis and wadi fans, such as *Pteropium scoparium*, also occur. (2) The *Euphorbia larica* zone at 1,000–1,500 m in which *E. larica* is the characteristic species, associated with *A. tortilis*, *A. gerardii* and *Periploca aphylla*. (3) The *Sideroxylon-Olea-Dodonaea* zone at 1,100–2,500 m in which the characteristic species *Olea europaea*, *Sideroxylon mascatense* and *Dodonaea viscosa* are associated with shrubs and subshrubs to form the dominant woody vegetation of the mountains. (4) The *Juniperus-Ephedra-Teucrium* zone occupies the summit areas at 2,100–3,000 m of the central range of the Western Hajar mountains, where an isolated population of *Juniperus excelsa* subsp. *polycarpus* forms open woodlands, often co-dominant with *Olea europaea* up to 2,400 m. At altitudes below 2,400 m the juniper trees are generally in poor condition and regeneration is minimal (Fisher & Gardner 1995, Gardner & Fisher 1996). This zone does not occur in the Musandam mountains, where the summit vegetation above 1,800 m consists of an *Artemisia* steppe (Mandaville 1985).

### 2. Northern Foothill Vegetation

Vegetation of the foothills and immediate plains of the northern mountains. Much of this zone is inhabited, and date-palm groves, and domestic livestock are numerous. As a result the natural vegetation is largely degraded or replaced by cultivation. This zone is characterized by *Acacia tortilis* and a number of associated shrubs, and overlaps with the vegetation of the lower altitudes of the *Acacia-Rhazya-Fagonia* zone of the northern mountains. Wadis and wadi banks are rich in annual species.



### 3. Coastal Vegetation

The vegetation of the coasts, dominated by halophytes and other species associated with small stabilized coastal dunes. *Suaeda aegyptiaca* is the dominant species in sandy soils and saline depressions and occurs either in monospecific stands or in association with *Cornulaca monanantha*, *Cyperus conglomeratus*, *S. aegyptiaca*, *S. vermiculata*, *Limonium* and *Zygophyllum*. Within this broad zone the vegetation of the intertidal and spray zones can be classified into four communities, with the species composition dependent on topography, salinity and substrate, and the level and frequency of inundation by the sea (Ghazanfar 1999). These are: (1) *Limonium-Zygophyllum* community, characteristic of the coastal vegetation of northern Oman, where the coasts are mainly sandy and interspersed with rocky limestone headlands; dominant species are *Limonium stocksii*, *Suaeda vermiculata* and *Zygophyllum qatarense*. (2) *Suaeda-Limonium* community characteristic of the vegetation of the north-eastern coast. This type of vegetation is present on rocky shores with narrow beaches and a wide spray zone; *Limonium zygophyllum* and *Suaeda vermiculata* are the dominant species. (3) *Atriplex-Suaeda* community characteristic of offshore islands, flat sandy beaches and coastal sabkhas; the sandy substrate is usually fine, graded with mud and has a high content of marine carbonates; *Atriplex coronata*, *A. jarvisii*, *A. leucochlada*, *Suaeda vermiculata*, *S. monoica*, *S. moschata* and *Arthrocnemum macrostachyum* are the characteristic species. (4) *Limonium-Sporobolus-Urochondra* community characteristic of the vegetation of the southern coasts; the dominant species, *Limonium axillare*, *Urochondra setulosa* and *Sporobolus* spp., are associated with others depending on geomorphology; *Sporobolus virginicus*, *S. isladus* and *Paspalum vaginatum* are the main species in coastal lagoons. The mangrove *Avicennia marina* occurs throughout coastal Oman in discontinuous patches and in a wide range of water salinities (Ghazanfar 1996b).

### 4. Sabkha Vegetation

Vegetation of the saline plains, salt pans and coastal sabkhas. This vegetation type overlaps with the *Suaeda aegyptiaca* vegetation type in relatively less saline coastal habitats, resulting in mosaics that contain species of both vegetation types. An analysis of the vegetation of a large sabkha, the Barr al Hikman peninsula, shows the vegetation to be mainly coastal. In a 1 km wide belt around the coast the vegetation cover is low, c. 6.8% of the total area (Ghazanfar 1995a, 2001). Three main communities are distinguished: (1) A halophytic community of *Atriplex jarvisii* and *Suaeda moschata* along the coasts and sea inlets; monospecific stands of *Arthrocnemum* are present where the substrate is composed of loamy soils; salt pans are fringed with *Halopeplis*. (2) On the seaward side of coastal dunes, tussock-forming grasses such as *Urochondra* and *Cyperus conglomeratus* occur. (3) A community of *Limonium stocksii*, *Cyperus*, *Heliotropium* and *Zygophyllum* occurs on the flat gravel plains inland from the sea.

### 5. Gravel Plain Vegetation

Vegetation of the central and eastern gravel plains. Although a hyperarid area, frequent heavy fogs and dew enhance water availability, supporting growth of perennials during droughts. The vegetation consists of an open *Acacia* scrub with *A. tortilis*, *Ziziphus leucodermis*, *A. ehrenbergiana* and *Prosopis eluteraria* as the dominant woody components. Although limited in their distribution, *Rhusa arida*, *Pulicaria glutinosa* and *Zygophyllum* spp. form a major component of the low shrubby vegetation. There is a ground cover of several species of grasses of which *Stipagrostis saboterrana*, a dominant grass on low gravel ridges, is an important food source for Arabian oryx. Oryx leucon reintroduced in this region (Price 1989, Spalton 1999). Other species include the endemic species *Convolvulus oppositifolia*, *Ocbradenus harsusiticus* and *Pulicaria pulvinata*. *Namorrhops ritchiana* and *Pulicaria undulata* are also found there. The endemic *Hyoscyamus gallowayii* occurs on the coastal limestone hills.

### 6. Sand Dune Vegetation

Vegetation of the sandy deserts in the east and west of Oman. The dominant tree species is *Prosopis cineraria*, which exists as fragmented open woodlands in the east and south-west. These relict woodlands are sparse and highly degraded and exhibit little or no regeneration. *Calligonum crinitum* is the only large shrub, common on stabilized sand dunes. Other species include *Cyperus conglomeratus*, *Heliotropium kotschy*, *Zygophyllum qatarense* and *Z. hamense*.

### 7. Western Gravel Plain Vegetation

Vegetation of the western part of the central plains. A hyperarid area with an impoverished flora of only c. 100 species. Vast areas are bare of vegetation, most of which is restricted to wadi fans, shallow depressions and runnels. *Acacia tortilis* is the only tree, and *Cornulaca* spp., *Heliotropium kotschy* and *Zygophyllum qatarense* are the main sub-shrubs.

### 8. Semi-desert Grassland Vegetation

Vegetation of the southern coastal plains. The dominant vegetation consists of scattered trees of *Acacia tortilis*, and on rocky outcrops xerophytic shrubs such as *Cadaba* spp., *Caesalpinia eri-anthera* and *Commiphora* spp. are present in association with *Adenium obesum*, *Caralluma flava*, *Sansevieria ehrenbergii*, *Kleinia odora*, *Euphorbia cactus* and *Aloe* spp. On the soft coastal soils species of *Salsola* and *Suaeda*, and *Euphorbia hardamautica*, *Vernonia arabica*, *Heliotropium far-takense*, *Limonium axillare* and the creeper *Ipomoea pes-caprae* occur (Miller & Morris 1988). Much of the vegetation of the coastal plains has been destroyed by anthropogenic influences such as overgrazing. However, after rain ephemeral herbs and grasses cover the plains. At the foot of the Dhofar mountains there is a distinct zone dominated by *Boscia arabica*. Associated trees and shrubs are species of *Commiphora*, *Jatropha dhofarica*, *Croton confertus*, and the common succulent creeper *Cissus quadrangularis*. The endemic *Cibirhiza dhofarensis* also occurs in this zone.

### 9. Southern Escarpment Woodland and Plateau Vegetation Type

Vegetation of the southern mountains. There is a zonation of species correlated with altitude and topography. Distinct plant communities are present on the seaward facing slopes (that receive the monsoon mists and cloud), the summit areas, and the drier north-facing slopes (Miller & Morris 1988, Sale 1980): (1) Up to c. 500 m on the seaward-facing slopes of the escarpment mountains there is a deciduous woodland and thicket with *Acacia seyal*, *Commiphora* spp. and *Maytenus dhofarensis*. The open slopes are dominated by trees such as the regionally endemic *Anogeissus dhofarica*, *Sterculia africana*, *Delonix elata* and other species. A thick ground cover of herbaceous shrubs, climbers and ferns is also present. The escarpment valleys and gorges are lined with riparian woodlands of *Ficus* spp. and *Tamarindus indica*. (2) Above 500 m to the summit the deciduous woodland is gradually replaced with a semi-evergreen thicket and woodland dominated by species such as *Olea europaea* subsp. *cuspidata*, *Euclea racemosa* subsp. *schimperii*, *Commiphora* spp., *Dodonaea viscosa* (syn. *D. angustifolia*), *Carrisa spinarum* and *Euphorbia balsamifera*. (3) A grassland zone is present on the summit and gentle mountain slopes, with *Apluda mutica*, *Themeda* and *Cenchrus* spp. being common, and several common herbs such as *Impatiens balsamifera* and the regionally endemic *Dyschoriste dalyi*. (4) Further inland on the escarpment mountains the influence of the monsoon mist and cloud is reduced, and there is a concomitant vegetation change; the taller trees are replaced by a dwarf shrubland dominated by *Euphorbia balsamifera* and stunted *Commiphora* spp. (Miller & Morris 1988), with several associated woody herbs and xerophytic shrubs. (5) Further inland, xerophytic trees, shrubs and succulent herbs dominate that include species such as *Acacia etbaica*, *Cocculus balfourii*, *Dracaena serrulata*, the monotypic *Dhofaria macleishii* and



scattered trees of the frankincense tree, *Boswellia sacra*. *Boswellia sacra* occurs from about the Hasik area in southeast Dhofar westward to the Hadramaut in Yemen.

## Phytogeography and Endemism

The composition of the flora of Oman is influenced by the Saharo-Sindian phytochorion in west and central Oman and the Somalia-Masai phytochorion in the south. The Saharo-Sindian Regional Zone is the largest phytochorion on the Arabian Peninsula, and has been divided into the Nubo-Sindian Local Centre of Endemism (Nubo-Sindian province of the Sudanian region *sensu* Zohary 1966 and 1973, and the Sudano-Deccanian *sensu* Eigg 1938) and the Arabian Regional Subzone (Saharo-Arabian region *sensu* Zohary 1966 and 1973, the Saharo-Sindian *sensu* Eigg 1938, and the Saharan Regional Subzone *pro parte* Leonard 1989) (White & Leonard 1991, Leonard 1989).

The Saharo-Sindian flora of the Arabian Peninsula developed during the Middle to Late Miocene under the influence of increasing aridity. The flora is derived from the palaeo-African vegetation that occupied the western parts of Arabia throughout the Middle-Late Eocene and Oligocene (c. 50–24 M yrs BP) before the African-Arabian rift occurred. This palaeotropical vegetation persisted in the western and southwestern highlands of the Arabian Peninsula and was the precursor of the Sudanian (including the Nubo-Sindian, Arabian Regional Subzone and Eritreo-Arabian province of the Sudanian region, Zohary 1973) vegetation (Kürschner 1998, Mandaville 1984). During the Middle Miocene (c. 10 M yrs BP) part of this flora migrated eastwards through large flow-cut channels from the western Arabian mountains and formed part of the present Arabian Regional Subzone flora (*Acacia* and associated vegetation). However the oldest section of the Oman (and Arabian) flora is the desert and semi-desert flora of the Arabian Regional Subzone derived from a Cretaceous Mediterranean flora formerly located along the coasts of the Tethys Sea (Zohary 1973). Colonization of central Arabia by this flora occurred with the closure of the Tethys Sea during the Late Cretaceous-Early Eocene (c. 60–58 M yrs BP).

### Nubo-Sindian Local Centre of Endemism

The Nubo-Sindian Local Centre of Endemism occupies the northern mountains, foothills and the northern coast of Oman (Omano-Sindian area, *pro parte*, Leonard 1989). The flora of this phytochorion is often difficult to delimit from that of the adjacent Arabian Regional Subzone and merges with it in several areas. The flora originates from a xero-tropical tree flora of palaeotropical origin (the *Acacia* flora) of desertic habitats, modified by high temperatures and low rainfall from the typical tropical vegetation, the *Acacia-Commiphora* flora of the Somalia-Masai Regional Zone, to one of scattered trees associated with a ground vegetation of dwarf shrubs and grasses (pseudo-savannas *sensu* Kürschner 1998, Zohary 1973).

The flora of these areas has close links with the montane flora of southwestern Iran, Afghanistan and Baluchistan (south-west Pakistan) (Ghazanfar 1991a) and has been classified as an Omani-Makranian subprovince (Kürschner 1986). This can be seen in the distribution of species such as *Convolvulus virgatus*, *Dianthus crinitus*, *Ebenus stellata*, *Jaubertia aucheri*, *Ochradenus aucheri*, *Physanthus thymaenifolius*, *Rubus infundibularis* and *Teucrium stockianum* (cf. Omani-Makranian subprovince, Kürschner 1986, 1998). Communities on the northern mountains with *Juniperus excelsa* subsp. *polycarpa*, *Helianthemum lippi* and *Lepidra pachyclada*, and associated species such as *Leptorhabdos parviflora*, *Sageretia thea* and *Combretum ulmerianum*, and species in the foothills such as *Blepharis ciliaris*, *Lagotis indica*, *Ochradenus baccatus*, *Maerua crassifolia* and *Tephrosia apollinea*, further indicate these close floristic links. It has been suggested that the migration of Nubo-Sindian floristic elements probably took place during the Pleistocene, especially during 17,000–13,000 yrs BP, when sea

levels were low and the Arabian Gulf was virtually dry (Ghazanfar 1998a, Sanlaville 1992). However, Mandaville (1984) considers *Blepharis ciliaris* and *Ephedra pachyclada* and other associated species such as those of *Acacia* and *Ziziphus* as Sudanian relicts that migrated from western Arabia through flow-cut channels during the late Pliocene.

The northern mountains of Oman, including the Musandam mountains, are one of the three local centres of endemism in the country. Both species diversity and endemism are high compared to that of the foothills or central plains. Approximately 25 species are nationally or regionally endemic, of which most are uncommon and restricted to one or two locations in the mountains (Ghazanfar 1998b). The common species are *Dionysia mira*, *Rhus aucheri*, *Pteropium scoparium*, *Schweinfurthia imbricata*, *Verbascum akhdarens* and *Ziziphus hajarensis*. *Ceratonia oreothauma* subsp. *oreothauma*, a tree species with a disjunct distribution, occurring in eastern Yemen, Somalia and northern Oman, is endemic to the summit regions of the eastern Hajar mountains.

### *Arabian Regional Subzone*

The central region of Oman has been classified as part of the Saharan Regional Subzone of the Saharo-Sindian Zone (Ghazanfar 1992b) that extends from North Africa. However, recent vegetation studies (Ghazanfar 2002) have shown that the vegetation of this area is best classified in the Arabian Regional Subzone. This subzone occupies the central region of Oman and overlaps with the Nubo-Sindian Local Centre of Endemism in the foothills of northern Oman. The flora is poor in species and consists of derivatives of an ancient stock of species formerly distributed along the northern and southern coasts of the Tethys Sea. Typical species of this stock are *Anastatica hierochuntica*, *Calligonum* spp., *Cornulaca* spp., *Diploaxis harra*, *Haloxylon salicornicum*, *Fagonia* spp., *Helianthemum lippii*, *Morettia* spp., *Neurada procumbens*, *Paronychia arabica*, *Polycarpaea repens*, *Rhazya stricta*, *Sclerocephalus arabicus*, *Scrophularia deserti*, *Stipagrostis* spp. and *Tamarix* spp. (Kürschner 1998).

The vegetation of this region conforms with the *Acacia* communities and halogypsophilous vegetation described by White (1983). *Acacia tortilis*, *A. chrenbergiana*, *Maerua crassifolia*, *Calotropis procera* and *Salvadora persica* form the larger woody vegetation, and *Cassia italica*, *Setzenia africana* and *Panicum turgidum* the shrubby and herbaceous vegetation. In the halogypsophilous vegetation (on salt pans known as *sabkha*) species of *Arthrocnemum*, *Limonium*, *Salsola*, *Suaeda* and *Zygophyllum* occur. Representatives of endemic Saharan genera such as *Anabasis*, *Anastatica*, *Neurada*, *Ochradenus* and *Zilla* occur in this region, and other species such as *Cornulaca monacantha*, *C. aucheri*, *Haloxylon salicornicum*, *Lasiurus scindicus*, *Heliotropium* spp. and *Stipagrostis* spp. are common. Saharo-Sindian endemics such as *Astragalus tribuloides*, *Bassia eriophora*, *Cakile arabica*, *Centaurea pseudo-sinaitica*, *Cornulaca aucheri*, *Haloxylon salicornicum*, *Paronychia arabica*, *Rhazya stricta*, *Scrophularia deserti* and *Suaeda aegyptiaca* occur in this zone in Oman.

The limestone plateau of central Oman, classified as a local centre of endemism (Miller & Nyberg 1991), is included in this zone. Although species richness is low, there are 11 endemic species. In this hyperarid region supplemental moisture is provided by heavy dews and fogs, the occurrence of which is evident from the growth of corticolous and saxicolous lichens. Amongst the common endemics are *Ochradenus barsusiticus*, a low shrub distributed widely on the plateau, *Hyoscyamus gallagheri*, *Convolvulus oppositifolia*, *Campylanthus sedoides* and *Pultenaea pulvinata*. 5% of the flora in this phytochorion is endemic to the Arabian Peninsula, including species such as *Stipagrostis sokotrana*, *Euphorbia riebeckii* and *Echbiobilon jugatum* (Cope 1988).

### *Somalia-Masai Regional Centre of Endemism*

South-west Oman falls within this zone (Eritreo-Arabian province of the Sudanian region; Zohary 1973, *pro parte*). It includes the Dhofar escarpment mountains that extend into the



Mahrah region of Yemen, the southeastern coastal plain extending northwards and overlapping with the Arabian Regional Subzone, and the north facing slopes of the southern escarpments. The Dhofar escarpment mountains come under the influence of the south-west monsoon, which during July and August give rise to dense mists and cloud, precipitation from which forms an important source of water for the vegetation (Price et al. 1988).

The vegetation of Dhofar can be broadly classified as the *Acacia-Commiphora* deciduous bushland and thicket (White 1983). The flora nearly always includes species of *Acacia*, *Carissa*, *Commiphora*, *Dalmanella*, *Euclea*, succulent species of *Euphorbia*, *Grewia*, *Olea*, and *Sansevieria*, and species of the family Capparaceae. Taxa such as *Acacia mellifera*, *A. nilotica*, *A. tortilis*, *Adansonia digitata*, *Albizia* spp., *Cordia alliodora*, *Caralluma* spp., *Cissampelos grandifolia*, *Commiphora* spp., *Dalmanella* spp., *Sarcocolla* spp. and *Sterculia africana* occur throughout this region. Perennial grasses are not abundant but annual grasses, which appear after the rains, constitute an important component of this phytochorion in Oman.

The escarpment woodlands of Dhofar are classified as a local centre of endemism, with 57 endemic and regionally endemic taxa, including two genera, *Cibulbiza* and *Dhofaria*. Three of the eight endemic genera of the Somalia-Masai region are represented in Dhofar: *Hildebrandtia*, *Kellermania* and *Lochnera*, each with a single species. *Dorstenia foetida*, a regional endemic, also occurs in Dhofar. Many of the nationally and regionally endemic taxa are common and form part of the woody vegetation of the mountains. These are trees such as *Acacia dhofarica*, *Euphorbia umbellata*, *Jatropha dhofarica* and *Blepharispermum hirtum*, and shrubs and herbs such as *Betula dhofarica*, *Blepharis dhofarica*, *Lavandula dhofarica*, *Oenocarpus dhofarica*, *Dioscorea dhofarica* and *Aloe dhofarica* (Ghazanfar 1998b). Regional non-endemic species that extend north beyond the Somalia-Masai region include *Aristida mutabilis*, *Seddera latifolia*, *Stipagrostis hirtigluma*, *S. uniplumis* and *Tamarix aphylla*.

Disjunct and Relict Species

The geological, climatic and floristic history of the Arabian Peninsula has resulted in the presence of Mesic-African relicts, and disjunct distribution patterns in certain genera of palaeo-African and Asian origin. Mesic-African relicts are taxa such as those of *Commiphora*, *Euphorbia*, *Grewia*, *Habenaria*, *Vernonia*, and grasses such as *Aristida*, *Arthraxon* spp., *Eragrostis*, *Lycopodium*, *Polypodium*, *Sparganium* and *Typha*. Palaeo-African genera that have their centre of speciation in south-west Arabia (including Dhofar) and their closest relative in Africa are *Acacia*, *Commiphora*, *Dorstenia*, *Euclea*, *Ficus*, *Grewia*, *Habenaria*, *Maytenus*, *Oenocarpus* and *Schweinfurthia* (Jonsell 1986, Petrusson & Thulin 1966, Sebsebe 1985). Mesic-Asian relicts in the Oman flora occur mostly in the northern mountains, although some taxa, such as *Epipactis* and *Plectranthus*, also occur in Dhofar. The Mesic-Asian relicts are *Dioscorea*, *Epipactis*, *Plectranthus*, *Leptochloa*, *Sclerocarya*, *Sclerocarya*, *Tecomella*, and grasses such as *Aeluropus*, *Cymbopogon*, *Eleusine*, *Eragrostis*, *Lycopodium* and *Typha*.

Although most plant migration into the Peninsula was from Africa to Asia, some species migrated in the opposite direction. This is illustrated by the disjunct distribution of *Sclerocarya*. The main area of its distribution is Afghanistan and northern Pakistan, but it also occurs in the mountains of northern Oman and south-west Saudi Arabia, Somalia, Djibouti and Ethiopia.

An example of a disjunct pattern of distribution and a relict species is seen with the monotypic genus *Ceratonia*. *C. ceratonia* subsp. *ceratonia* occurs in the eastern part of the Hajar mountains, eastern Yemen and Somalia. The origin of *Ceratonia* is obscure but it is believed to be eastern Mediterranean (Winer 1980).

Conservation

The main threat to plant diversity in Oman, as across the whole of the Arabian Peninsula, is the continued degradation of habitats, especially that of rangelands. Overgrazing, identified as a serious problem in a rangeland survey conducted in the early 1980s (Anon. 1982), has now reached epidemic proportions, and it has been suggested that if the present trend continues most rangelands will be completely treeless and weed-infested within 20–30 years (Anon. 1995).

Threats from invasive species (especially from the spread of *Prosopis juliflora*, which has been used as a landscaping tree) has recently been recognized. The spread of this invasive alien has now reached unprecedented proportions in southern Oman, where some 2.3 million self-seeded young trees are present in a small section of the Dhofar coastal plain (Ghazanfar 1996c). There is great concern over its spread to the escarpment mountains through seed deposited by browsing camels.

Threatened Flora

Applying the IUCN Red List categories at a national scale, 37 taxa in the flora of Oman have been identified as threatened (Critically Endangered, Endangered or Vulnerable), of which 29 species are endemic or regionally endemic. Nine species are Critically Endangered, all occurring in the escarpment mountains of Dhofar. Of these, eight are in the family Asclepiadaceae, predominantly in the succulent genera *Caralluma*, *Rhytidocaulon* and *Pachycymbium*. Two species, *Aloe whitcombei* and *Rhytidocaulon fulleri*, are endemic to Dhofar. All of these nine species have a restricted distribution and are at threat from road development, housing projects, overgrazing and over-collection by succulent enthusiasts. *Caralluma adenensis* and *Dorstenia foetida*, both distributed in Dhofar, are categorized as Endangered; they have a patchy distribution and recently built roads have unfortunately provided access to their localities. Twenty-six species are categorized as Vulnerable, with the majority occurring in Dhofar. Most of the species in this category are trees and succulent asclepiads. The trees are heavily browsed and lopped for fodder and exhibit little or no regeneration. These include the endemic *Ceratonia oreothauma* subsp. *oreothauma* in the eastern Hajar mountains of northern Oman, the regionally endemic *Anogeissus dhofarica* in the mountains of Dhofar, the mangrove *Avicennia marina* in the coastal areas of Dhofar and northern Oman, *Dracaena serrulata*, *Boscia arabica* and the frankincense tree *Boswellia sacra* in Dhofar. These trees and their habitats are in urgent need of protection. Nineteen species are categorized as Least Concern, seven of which are endemic or regionally endemic to Dhofar. Terrestrial orchids and *Juniperus excelsa* subsp. *polycarpus* are included in this category. Three grass species lack full data on their status and are therefore categorized as Data Deficient.

Table 1. Number of plant species categorized in the IUCN Red List categories: CR Critically Endangered; EN Endangered; VU Vulnerable; LC Least Concern; DD Data Deficient. (From Ghazanfar 1998c).

IUCN Red List categories	CR	EN	VU	LC	DD
Number of species	9	2	26	19	3

Threatened Habitats

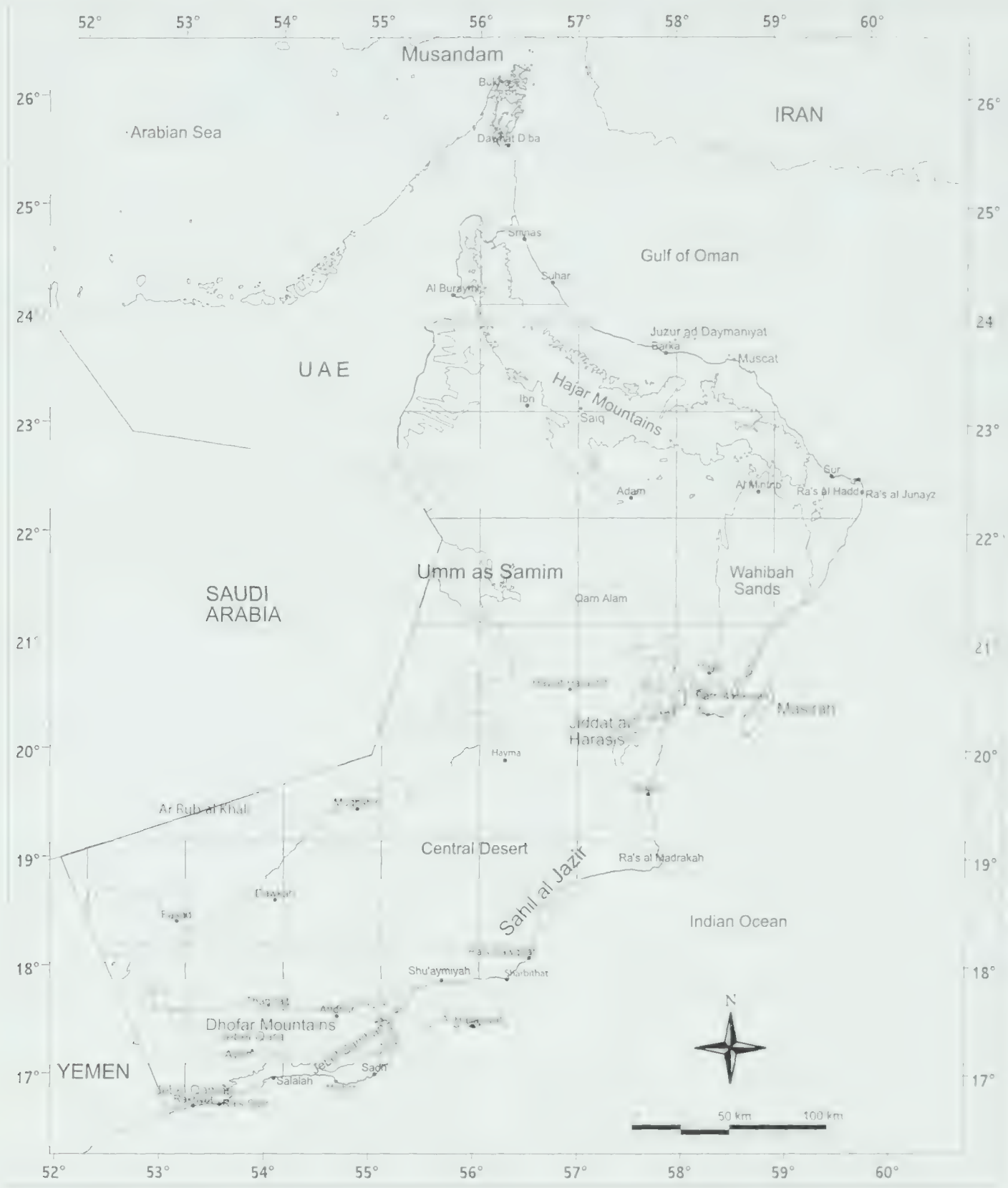
The most threatened region is Dhofar, where severe overgrazing and fast-growing development has led to the rapid degradation of most habitats. Within the last 15 years improved road access, availability of fresh water from bore holes, government subsidized supplementary feed for livestock and improved veterinary services have led to increases in livestock holdings far



above the forage capacity of the mountain rangelands. Traditional patterns of stock management are no longer followed and up to 30,000 camels have been reported from a single area in Dhofar after the monsoon. Severe environmental degradation, and in some areas a sharp decline in populations of most palatable annual plant species, especially those of grasses, and the establishment of invasive species have been recorded (Ghazanfar 1998b).

The problem is similar in northern Oman, including Musandam, where species rich habitats in the northern mountains are at threat from over-browsing and grazing by goats and feral donkeys. The annual vegetation is not as rich in species as that of Dhofar, and the threat is largely to the shrubs and trees whose young shoots and fruits are heavily utilized by livestock. Young branches, especially those of *Olea*, are cut and fresh leaves lopped for fodder. Young pods of leguminous trees such as *Ceratonia orcutluum* subsp. *arcutluum*, *Prosopis cineraria* and *Acacia* spp. are also lopped for fodder, hence reducing recruitment. More recently, clearing for houses, tourist hotels and fruit orchards (especially in the relatively moderate climate of the mountains) and road building pose equally severe threats to threatened sites and species-rich habitats. In order for biodiversity conservation to be effectively implemented threatened sites and species-rich habitats must be taken into consideration in the planning of housing schemes, hotels and agricultural facilities.

Coastal habitats are also threatened, with the most serious threat being from indiscriminate development of local fishing sites, waste disposal and off-road driving. Coastal regions are unique both in their floral and faunal features and support a rich population of halophytic shrubs, including the endemic *Suaeda monchana*. Several areas on the eastern coast support dense stands of mangroves, and several species of sea grasses occur in shallow bays and tidal lagoons. The coastal areas of Barr al Hikman, which are under pressure from development, are in urgent need of management.



Physical features and main locations of the Sultanate of Oman. Contours of the Hajar, Dhofar and Musandam mountains at 500 m.



## 1. Piperaceae

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- Düll, R. (1973). Die Peperomia-Arten Afrikas. *Bot. Jahrb. Syst.* 93: 56–129.
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### Peperomia Ruiz Lopez & Pavón

About 1000 species distributed mainly in tropical America, some in tropical Africa and Asia.

*Peperomia pellucida* (L.) Kunth in Humb. Bonpl. & Kunth, Nov. Gen. Sp. 1: 64 (1815).

*Synonyms*: *Piper pellucidum* L. (1753).

*Description*: Annual herb, epiphytic. Stems erect to ascending or prostrate, 4–6 cm, unbranched, thin and delicate, glabrous. Leaves alternate, petiolate, translucent, 7–11 × 7–17 mm, orbicular to cordate, 5–7-nerved, glabrous, apex obtuse, rounded or acute, base cordate; petiole 3–7 mm. Flowers minute, in somewhat fleshy terminal spikes; spikes solitary, leaf-opposed, perianth absent, stamens 2; ovary single. Fruit (drupe), subglobose, ± 0.5 mm in diameter, minutely tuberculate.

*Flowering and fruiting*: September, October.

*Distribution and habitat*: Southern Oman, Dhofar, on the wet escarpment woodlands. Grows in damp, shady places on moist or wet rocks and in crevices of rocks. Often present on moist limestone rocks and stones behind seasonal and permanent water drips and water falls. *Altitude*: 200–1500 m. Pan-tropical. Elsewhere in the Arabian Peninsula found in Yemen.

*Distribution map*: Fig. 1. *Illustration*: Plates 1, 2.

*Note*: The species is not common in Oman and occurs only at a few locations on the Dhofar mountains where there is shade and permanent moisture. The plants come up after the monsoon rains.

## 2. Aristolochiaceae

### Bibliography

- Huber, H. (1993). Aristolochiaceae. In: *The Families and Genera of Vascular Plants, Flowering Plants, Dicotyledons: Magnoliid, Hamamelid and Caryophyllid Families* (eds K. Kubitzki, J.G. Rohwer & V. Bittrich), Vol. II, pp. 129–137. Springer-Verlag, Berlin.
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**Aristolochia L.**

About 400 species, distributed in S Europe, tropical Africa, Sri Lanka and Pakistan.

*Aristolochia bracteolata* Lam., Encycl. Méth. Bot. 1: 258 (1783).

*Synonyms:* *Aristolochia bracteata* Retz. (1788).

*Vernacular names:* ghaghā, loiya.

*Description:* Short lived perennial or annual herb. Stems weak, branched, prostrate, often climbing. Leaves alternate, petiolate, grey-green, glabrous, 25–45 × 30–50 mm, cordate, margin crenate; petiole 10–15 mm. Bracts similar to leaves in shape but much smaller. Flowers in the axils of leaves, solitary, unpleasant to smell; calyx tubular below, expanded above, bent into a pipe-shape; calyx tube inflated at the base, greyish-green, upper part dark-red, inner surface of the upper portion covered with dark red nectariferous hairs. Ovary inferior. Fruit 14–15 × 19–20 mm, oblong, flattened at the top, splitting; seeds subglobose, appearing heart-shaped in dried specimens, ± 5 mm long, black, with small rounded tubercles at the back.

*Flowering and fruiting:* March to June and November, December in the northern and central regions; September to October in the southern region.

*Distribution and habitat:* Throughout Oman, usually in disturbed and cultivated locations in the foothills and lower altitudes of the northern mountains, coastal plains and on foothills and mountains in Dhofar. Common in wadis and cultivated date gardens, trailing and climbing over fences and shrubs. Occasional in the gravel desert where it is associated with cultivation.

*Altitude:* 0–1700 m. Distributed in E and NE Africa, westwards to Nigeria. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 2. *Illustration:* Plate 3.

*Notes:* The plant has been used in traditional medicine to treat snake and scorpion bites and skin problems.

### 3. Ceratophyllaceae

#### *Bibliography*

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- Wilmot-Dear, M. (1985). *Ceratophyllum* revised - a study in fruit and leaf variation. *Kew Bull.* 40: 243–271.

**Ceratophyllum L.**

About 100 species, worldwide in distribution.

*Ceratophyllum demersum* L., Sp. Pl. 992 (1753).

*Description:* Submerged monoecious perennial herb, up to 2 m, free-floating, rootless, perennating by buds. Leaves whorled, 1–4 cm, dichotomously branched twice, rarely once, linear, margins minutely toothed. Flowers unisexual, sessile, in the axils of leaves, the male and female



flowers at separate nodes; male flowers many in a whorl, 1–3 per node, 2–3 mm on several consecutive nodes; stamens many, spirally arranged. female flowers fewer in a whorl, 1 per node; perianth segments linear or strap-shaped, united at the base, with two apical teeth and a central micro. Fruit ovoid or ellipsoid, 4–5 mm, with two basal spines and the persistent style forming an apical spine.

*Flowering and fruiting:* ?March.

*Distribution and habitat:* Southern Oman. Dhofar, on the mountains and coastal plains, in permanent pools, slow moving streams and sea inlets. *Altitude:* 20–350 m. Cosmopolitan in distribution. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (N).

*Distribution map:* Fig. 3

*Notes:* An uncommon aquatic in Oman, and so far recorded only from Khawr Rawri on the Dhofar coastal plains and from the pools of Wadi Darbat on Jebel Qara. The species is not tolerant of highly saline water and is found on the landward side of Khawr Rawri which is relatively fresh as it receives fresh water from Wadi Darbat.

4. Ranunculaceae

*Bibliography*

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Key to the genera of Ranunculaceae in Oman

- A. Perennial herbs or subshrubs, often climbing. Leaves opposite. Flowers cream (in Oman). Fruit with a long plumose tip. . . . .1. **Clematis**
- A\*. Annual herbs. Leaves alternate. Flowers bright yellow (in Oman). Fruit with a small beak and without a plumose tip. . . . .2. **Ranunculus**

1. **Clematis** L.  
About 230 species, distributed in the north temperate regions, with a few species present on the African mountains.

1. *Clematis orientalis* L., Sp. Pl. 543 (1753).  
*Vernacular name:* khaymarān.

*Description:* Perennial herb with a woody base. Stems up to 50 cm, erect to decumbent, sometimes trailing or climbing. Leaves opposite, petiolate, glabrous, usually lobed into 3 segments, or lobes undeveloped, each segment with a micro at the apex; petiole up to 30 mm. Flowers in cymes, terminal on the stem; pedicel 30–40 mm; petals 5, free, pale yellow, distinctly brown-nerved, white at the margins, white-pubescent on both surfaces, inner surface and margins densely hairy; stamens numerous; carpels numerous, free. Fruit (achene) with a white plumose tip.

*Flowering and fruiting*: April to June.

*Distribution and habitat*: Northern Oman, in the Jebel Akhdhar range of the western Hajar mountains. Often found growing under juniper trees or climbing over shrubs in the shade of rocks and boulders. *Altitude*: 500–3000 m. Distributed in SE Europe, SW Asia, NW India and C Asia. Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 4. *Illustration*: Plates 4, 5.

*Notes*: A common plant in the northern mountains. The odour of crushed leaves produces a burning sensation in the nose.

## 2. *Ranunculus* L.

About 250 species, distributed in the temperate regions of the world.

*Ranunculus muricatus* L., Sp. Pl. 555 (1753).

*Description*: Annual herb. Stems up to 35 cm, branched, erect to ascending, glabrous or sparsely hairy. Leaves arising from the base of the stem, petiolate, 25–40 × 20–50 mm, cordate, usually with 3 main lobes, each lobe further divided into 2–3 lobes; petiole up to 15 cm. Flowers solitary, terminal; peduncles 10–16 cm, elongating in fruit; sepals 5, deciduous; petals 5, 4.5–7 × 3–4 mm. Fruit (achenes) forming a cluster, each 6–7 mm long (including the beak), dark brown, covered with soft tubercled spines.

*Flowering and fruiting*: March to early May.

*Distribution and habitat*: Northern Oman, on the mountains and foothills of the western Hajar, in cultivated date gardens, in shady and damp locations. Not common, and so far known only from northern Oman. *Altitude*: 300–1800 m. Distributed in S Europe, SW Asia, N Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map*: Fig. 5.

## Species wrongly recorded from Oman

*Delphinium penicellatum* Boiss., Ann. Sci. Nat. ser. 2, 16: 369 (1841).

Described and recorded by E. Boissier (1841) and in *Fl. Orientalis* 1867: Vol I, p. 91, apparently based on a collection by P.R.M. Aucher-Eloy from Oman (Arabiae, Mascate, No. 4034, P). Aucher-Eloy's personal field note-book does not include this specimen from Oman, and in his note-book the label for this entry is "*Sida radicans*". *Delphinium penicellatum* is found on the mountains of SW Iran and it is suggested that the collection has been mislabeled (see Ghazanfar in *Taxon* 45: 609–626 (1996)).

## 5. Berberidaceae

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**Berberis L.**

450 species distributed in Europe, N Africa, N America and Asia, with a few species found in the mountains of tropical Africa.

*Berberis baluchistanica* Ahrendt, J. Asiat. Soc. Beng. (Sci.) 11: 1 (1945) & J. Linn. Soc. Bot. 57: 87 (1961). *Type*: Baluchistan, Larghun, *Gamble* 2 (K!).

*Synonymy*: *Berberis holstii* Engler (1894), sensu auct., D.I. Chamberlain in A.G. Miller & T.A. Cope eds, *Flora of the Arabian Peninsula and Socotra* 1: 318 (1996).

*Description*. Perennial shrubs up to 2 m, spiny. Stems grooved, purple-red, glabrous; spines 3(–1)-fid, rarely 1-fid, 1–1.5 cm long. Leaves alternate, red when young, sessile, glabrous, present in fascicles of 5–10, lamina 10–18 × 4–7 mm, obovate, margin mostly entire at base, distinctly dentate at the apex, especially in older leaves, younger leaves with small spines on the margin, apex with a spinescent mucro. Flowers yellow, 6–10 in clusters or small racemes. Pedicel 4–6 mm, slender. Petals 6, 5–6 mm, obovate; stamens 6. Berry ellipsoid, 6–8 × 4–5 mm, dark red to deep purple-blue when ripe, pruinose; style short, ± 0.5 mm.

*Flowering and fruiting*: June to September.

*Distribution and habitat*: Northern Oman, distributed at high altitudes on the summit plateau in the Jebel Akhdhar range of the western Hajar mountains, growing with juniper and olive trees. The young, new shoots are conspicuously red. Not found on the eastern Hajar. *Altitude*: 2300–3000 m. Distributed in Baluchistan (SW Pakistan). Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 6. *Illustration*: Plates 6, 7.

*Note*: Chamberlain (op. cit.) has treated this species under *Berberis holstii*. I have seen the type and other collections of *B. baluchistanica* from Baluchistan and note that the species is distinct from *B. holstii* in its leaf and stem spines and consider it best treated under *B. baluchistanica*. The leaves in *B. baluchistanica* are spiny when young, distinguishably dentate when older and bear an apical spinescent mucro at the apex, while in *B. holstii* the leaves are entire, rarely with 1–2 spinules. In *B. baluchistanica* the stem spines are 3(–1)-fid, but in *B. holstii* they are 1(–3)-fid. *B. holstii* is found in East Africa (Somalia, Uganda, Kenya, Tanzania) and possibly in N Yemen. *B. baluchistanica* is found in Baluchistan and northern Oman.

*B. baluchistanica*, with other species such as *Helianthemum lippii*, *Ebenus stellatus* and *Sarcocolla ibex* form a community of woody shrubs and subshrubs that are distributed in the mountainous regions of Baluchistan, Iran and northern Oman. So far *B. baluchistanica* or *B. holstii* are not known from Dhofar.

**6. Menispermaceae**

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**Cocculus** DC. (nom. conserv.)*Cebatha* Forssk.; *Leaeba* Forssk.

11 species, distributed in the warm tropical regions of the world except America and Australia.

A. Lianes, climbing or trailing plants. Leaves persistent. Cladodes absent 1. *C. pendulus*A\*. Shrubs, often leafless (leaves soon falling). Cladodes present, spine-tipped  
..... 2. *C. balfourii*1. *Cocculus pendulus* (J.R. & G. Forst.) Diels in Engl., Pflanzenreich, Menispermac. (IV), 94: 237, f. 78 (1910).*Synonyms*: *Cocculus leaeba* DC. (1817); *Cebatha pendula* (J.R. & G. Forst.) Kuntze (1891).*Vernacular names*: ēsten (Jibbālī); nishtayn, sawmar.*Description*: Dioecious. Woody climber. Stems up to 10 m, white-pubescent, often climbing or trailing. Leaves 10–25 × 6–11 mm, ovate to oblong-ovate, grey-green, margin entire, apex obtuse with the midrib projecting; 3-veined from the base, veins indistinct. Flowers unisexual, minute, yellow-green, in the axils of leaves; male flowers in panicles; female flowers 1–2; sepals 6, in 2 whorls, c. 1 mm, ovate to orbicular; petals 6, c. 1.5 mm, emarginate, pubescent outside; carpels 6. Berries 1–2 together, globose, 5–7 mm in diameter, fleshy, red when ripe.*Flowering and fruiting*: April to October.*Distribution and habitat*: Throughout Oman, in dry, rocky wadis, on coastal limestone cliffs, climbing on trees and often growing in crevices, hanging off cliffs, or trailing along wadi beds.*Altitude*: 50–1800 m. Distributed in N Africa, tropical E Africa, S Iran, Pakistan, India. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.*Distribution map*: Fig. 7. *Illustration*: Plates 8, 9.2. *Cocculus balfourii* Schweinf. ex Balf. f. in Proc. Roy. Soc. Edinb. 11: 500 (1882); Balf. f. in Bot. Socotra 2, t. 1 (1888).*Vernacular names*: herum idheri (Jibbālī).*Description*: Dioecious. Perennial shrub, leafless. Branches puberulous, up to 1 m, dark green, profusely branched, arching or creeping. Leaves on young shoots falling soon. Cladodes bilaterally flattened, spine-tipped, 25–30 mm, grey-green with a dark tip, grooved (in herbarium specimens), bearing reduced bristle-like scale-leaves. Flowers small, sessile, creamy-white, in clusters at the edge of cladode or just beneath the cladodes; sepals 12–15, in 4–5 whorls, ± 1 mm, reducing in size outwards; petals 6, ± 2 mm, base auriculate, hairy on the outside; male flowers with 6–9 stamens; female flowers with 3 carpels. Fruit a drupe, ± 4 mm, red when mature.*Flowering and fruiting*: May to September.*Distribution and habitat*: Southern Oman, Dhofar, on the coastal escarpment cliffs, and inland in the drier areas and wadi beds, growing under shrubs, in the *Acacia Commiphora* scrub.*Altitude*: 50–850 m. Elsewhere in the Arabian Peninsula found in E Yemen and Soqatra.*Distribution map*: Fig. 8. *Illustration*: Plates 10–12.*Notes*: A regionally endemic species, originally described from Soqatra. Distributed in SE Arabia (E Yemen, S Oman and Soqatra). A curious looking species unlike other *Cocculus* species, not common, but restricted in its distribution in SW Dhofar.



7. Papaveraceae

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Key to the genera of Papaveraceae in Oman

- A. Leaves armed with prickles. Fruit dehiscing by longitudinal slits . . . . .1. **Argemone**
- A\*. Leaves unarmed. Fruit dehiscing by terminal pores . . . . .2. **Papaver**

1. **Argemone** L.

About 32 species, distributed in N, C and S America, the West Indies and Hawaii.

*Argemone mexicana* L., Sp. Pl. 508 (1753).  
*Vernacular names*: ghadrect, tashmezg (Jibbālī).

*Description*: Annual or a short-lived perennial herb, up to 1 m. Stems erect, branched, with straw-coloured long and short prickles; stems with yellow latex. Leaves sessile, 5–20 × 2–8 cm, elliptic to oblong in outline, pinnatifid, with prickles at the apex and margins of lobes, prickly and often variegated on the midrib. Bracts foliaceous. Flowers 3–8 cm across, solitary; sepals c. 10 × 6 mm, concave, imbricate; petals bright yellow, 4–6, obovate, delicate, soon falling. Capsule 2.5–4 × 1–2 cm, oblong, ribbed, covered with sharp prickles, splitting by 3–6 valves. Seeds small ( $\pm$  2 mm), many, covered with rounded tubercles.

*Flowering and fruiting*: September to May.

*Distribution and habitat*: Southern Oman, Dhofar, on the plains and summit areas, in open grasslands of the escarpment hills, and as a weed of fields and disturbed places. *Altitude*: 50–1800 m. Native of West Indies and Mexico, now naturalized in the warmer regions of the world as a weed. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, Yemen.

*Distribution map*: Fig. 9. *Illustration*: Plates 13, 14.

*Notes*: In Oman, the seeds have been used in traditional medicine as a demulcent, diuretic, for treating eye complaints, jaundice, as a laxative and narcotic.

2. **Papaver** L.

About 50 species, distributed in Europe, Asia, South Africa and North America.

- A. Capsule obovoid, ribbed, glabrous . . . . .1. **P. decaisnei**
- A\*. Capsule oval, smooth, often setose . . . . .2. **P. dubium**

1. *Papaver decaisnei* Hochst. & Steud ex Elkan, Tent. Mon. gen. Papav. 26 (1839).

*Description:* Annual herb. Stems 10–25 cm, erect, glaucous, usually glabrous, sometimes sparsely setose, containing a milky latex. Leaves pale green, slightly glaucous; basal leaves roughly oblanceolate in outline, 25–40 mm, pinnatifid or pinnatisect, with entire or toothed segments; cauline leaves similar but slightly smaller in size, amplexicaul. Flowers terminal, solitary, c. 2 cm in diameter; peduncles long, up to 17 cm, glabrous. Petals red to purple-red with a dark purple blotch at the base, 7–8 mm, broadly obovate, dentate at apex. Capsule pale green with pale yellow ribs, obovoid, to 16 × 8 mm, narrowing at the base, glabrous; stigmatic disc flat.

*Distribution and habitat:* Northern Oman, Musandam, in rocky wadis beds and on rocky slopes, amongst rocks and boulders. *Altitude:* 350–1220 m. Distributed in Egypt and SW Asia, from Jordan to Pakistan and Afghanistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map:* Fig. 10.

*Notes:* Not common but probably under-collected.

2. *Papaver dubium* L., Sp. Pl. 1196 (1753)

var. *laevigatum* (M. Bieb.) Kadereit, Edinb. J. Bot. 45(2): 244 (1988).

*Synonymy:* *Papaver laevigatum* M. Bieb. (1819).

*Description:* Annual herb. Stems decumbent, to 20 cm, setose. Leaves dull green, setose; basal leaves roughly oblanceolate in outline, 50–90 mm, pinnatifid or pinnatisect, with toothed segments. Flowers terminal, solitary, ± 2 cm in diameter; peduncles setose, up to 10 cm. Calyx pilose; petals 7–8 mm, obovate, dull red to purple. Capsule obconical (mature capsule not seen), green, glabrous or with a few hairs; stigmatic disc flat or slightly conical.

*Distribution and habitat:* Northern Oman, Musandam, in rocky wadis beds, amongst rocks and on gravel. *Altitude:* ± 1120 m. Distributed in SW Asia, from Jordan to Pakistan and Afghanistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 10.

*Notes:* The record is based on a single specimen from the summit area on Jebel Harim (Musandam). The material that I have seen from Iran and Baluchistan is very variable, and it seems that there is still confusion as to the true identity of *P. dubium* var. *laevigatum* and *P. decaisnei*. Therefore, I feel that the present treatment can only be tentative for Oman. More material is necessary to confirm the identity of *Papaver* species from Oman.

## 8. Fumariaceae

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**Fumaria L.**

55 species, distributed from the Mediterranean to C. Asia and Himalaya and the tropical East African highlands.

*Fumaria abyssinica* Hamm., Nova Acta Regiae Soc. Sci. Upsal. 3, 2: 275, t. 6 (1857).

*Vernacular names:* na'ina.

*Description:* Annual herb, up to 50 cm. Stems delicate, branched. Leaves alternate, dissected, 2-3 pinnately, leaf segments oblong, apex acute, glabrous; petiole usually long. Flowers 5-6 mm, in racemes; peduncles usually more than 5 mm; sepals  $\pm$  2 mm, ovate, margin obscurely toothed; petals 4, coherent, apparently bilabiate,  $\pm$  5 mm, pinkish white with dark red or maroon tips, upper petal keeled at the apex and with a short basal spur; inner petals spatulate, united at the apex, somewhat flared; stamens 3  $\times$  3. Capsule  $\pm$  2 mm, subglobose, 2-valved with 2 shallow apical pits (pits seen only in dried specimens).

*Flowering and fruiting:* February to March.

*Distribution and habitat:* Northern Oman, in moist, shaded and irrigated locations, as a weed of cultivation. *Altitude:* 800-2000 m. Distributed in tropical E and NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (N).

*Distribution map:* Fig. 11.

*Notes:* The plant has been used in traditional medicine as an anthelmintic, laxative, for dyspepsia, and skin problems.

## 9. Ulmaceae

*Bibliography*

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**Trema Lour.**

10-55 species, distributed in the tropics and subtropics; a single species in Africa and Arabia.

*Trema orientalis* (L.) Blume, Mus. bot. Lugh.-Bat. 2(4): 62 (1852).

*Synonyms:* *Celtis orientalis* L. (1753); *Trema guineensis* (Schumach.) Engl. var. *hochstetteri* (Buchinger) Engl. (1915).

*Description:* Monoecious, dioecious or polygamous. Tree or shrub, up to 10 m; bark smooth, whitish or grey; young shoots white appressed pubescent, older shoots with pale brown lenticels. Leaves alternate, 7-15(-20)  $\times$  3-7 cm, oblong-lanceolate, apex acuminate, base subcordate, margins finely serrate except for the base which is entire, pubescent to scabrid above, tomentose to pubescent beneath, 3-nerved at the base; petiole 5-10 mm, pubescent. Flowers male, female and bisexual, in small congested axillary cymes; calyx 4-lobed, lobes 1-2 mm, pubescent; petals absent; stamens 4; ovary pubescent; styles tomentose, white maturing red-

brown; usually persistent. Drupe 3–5 mm, ovoid to globose, glabrescent, green, turning black when mature.

*Flowering and fruiting:* September.

*Distribution and habitat:* Northern Oman and Dhofar, in the hills and escarpment mountains, on rocky hillsides and wadi slopes. Not common in northern Oman. *Altitude:* 800–1100 m. Distributed in tropical Africa, Madagascar and tropical Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (N).

*Distribution map:* Fig. 12.

*Notes:* A fast growing tree, which may have been introduced in Oman for timber and firewood. In northern Oman, recorded from Wadi Bani Auf in the western Hajar mountains, where it has been probably planted. The bark is reported to have insecticidal properties.

10. Moraceae

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Key to genera of Moraceae in Oman

- A. Small ± woody herbs, with a succulent, simple or branched stem. Flowers borne on a flattened receptacle surrounded by leaf-like appendages .....1. **Dorstenia**
- A\*. Woody trees and shrubs. Flowers in small spikes or flowers enclosed in hollowed receptacles
  - B. Flowers in small spikes. Cultivated, or naturalised in irrigated date gardens (in Oman) .....3. **Morus**
  - B\*. Flowers enclosed in a hollowed receptacle (fig). Native (except for *F. carica*, which is cultivated) .....2. **Ficus**

1. **Dorstenia** L.

About 105 species, distributed in the tropics, mainly neotropics and Africa.

*Dorstenia foetida* (Forssk.) Schweinf., in Bull. Herb. Boiss. 4, app. 2: 120 (1896).  
var. *foetida*

*Synonyms:* *Kosaria foetida* Forssk. (1775); *Dorstenia radiata* Lam. (1786); *Dorstenia arabica* Hemsley (1897).

*Vernacular names:* kartīb (Zufarī Arabic, Jibbālī); kertīb (Jibbālī).

*Description:* Monoecious. Succulent herb, up to 20 cm, with a swollen, simple or branched, cylindrical stem covered with prominent leaf scars, arising from a swollen tuberous base.



Leaves crowded at the top of the stem, 2–18×1–3 cm, elliptic to narrow-obovate, apex acute to rounded, base attenuate to rounded, margin entire to obscurely crenate or dentate, glabrous to puberulous; petiole 1–3 cm. Flowers unisexual, both male and female present on a flat disc-like receptacle; receptacle 5–15 mm in diameter, surrounded by leaf-like appendages; appendages 1–3 cm, in 2 rows, the inner row tooth-like, the outer subulate to filiform; peduncle 1–6 cm. Fruit (achene) expelling explosively.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment mountains (Jebel Qara, Jebel Samhan, Jebel Qamar), on cliffs and hillslopes, and in rock crevices in the *Euphorbia balsamifera* zone. Also occurring on the drier north facing slopes of the mountains in *Acacia-Commiphora* scrub. *Altitude:* 200–1600 m. Distributed in the Old World tropics, Sudan, Somalia, Ethiopia, Kenya, Tanzania. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 13. *Illustration:* Plate 15.

*Note:* The species is variable in its leaf characteristics. Plants with broadly obovate to suborbicular leaves and entire margins are placed under *D. foetida* var. *obovata* (A. Rich.) Schweinf. & Engl. in Engl., Monogr. afrik. Pflanzen-Fam. 1: 27 (1898). This variety is recorded from Yemen (N), Ethiopia and Sudan (Miller & Cope 1996). Though the Oman plants have elliptic to narrow-obovate leaves which fit the description of the typical variety, the leaf margins are variable in being entire to obscurely crenate to dentate. I have seen plants from SE Yemen (Al Mahira) that are similar to those from Dhofar (Oman) in their leaf characteristics. The name of this species is based on material collected from Yemen by P. Forsskål 327 (C).

Although the species is reasonably common in Dhofar, it is under threat in certain localities on the mountains from soil erosion caused by overgrazing, and by developmental projects including road building. It is also under threat from local plant collectors, local plant nurseries and succulent enthusiasts who collect vast numbers of whole plants for the curious shape of the plant and flowers. The present conservation status of this species in Oman is established as LC (Least Concern), however certain populations should be monitored and the threat status reassessed after a while.

The seeds have been used in traditional medicine for treating flatulence and indigestion. The stems are edible.

2. **Ficus** L.

About 800 species, distributed in the tropics, especially Indo-Malaysia.

- A. Leaves lobed or sometimes lobation obscure, margins dentate to serrate
  - B. Ripe figs less than 1.5 cm in diameter. Leaves palmately 3–5-lobed, sometimes deeply palmately 3–5-lobed with each linear lobe further irregularly dissected (in northern Oman only) . . . . . 3. **F. johannis**
  - B\*. Ripe figs 1.5 cm or more than 1.5 cm in diameter.
    - C. Leaves 3–5-lobed, up to 15(–17) cm . . . . . 1. **F. carica**
    - C\*. Leaves generally ovate to 3-lobed, up to 6.5 cm . . . . . 2. **F. palmata**
  - A\*. Leaves un-lobed, margins entire, sometimes undulate or obscurely dentate
    - D. Leaves narrow-ovate to oblong-ovate, glabrous and shiny. Figs up to 7 mm in diameter. [Figs green with pale green spots, ripening orange-red] . . . . . 5. **F. cordata**
    - D\*. Leaves ovate to ovate-orbicular. Figs more than 7 mm in diameter
      - E. Figs 2–4 cm in diameter, pedunculate, in dense branched clusters 4. **F. sycomorus**

- E\*. Figs up to 1 cm in diameter, sessile to subpedunculate, solitary or a few together  
 E. Leaves narrowly-ovate to oblong-ovate. Figs glabrous to tomentose. Ostiole with 3 bracts .....6. *F. ingens*  
 F\*. Leaves broadly-ovate to suborbicular. Figs tomentose. Ostiole 2-lipped  
 .....7. *F. vasta*

1. *Ficus carica* L., Sp. Pl. 1059 (1753).

*Vernacular names*: tīn.

*Description*: A large shrub or a small tree, up to 9 m tall, deciduous. Bark grey. Leaves stipulate, stipules falling soon leaving a scar; lamina variable in size and shape, 3–15 × 3–15(–17) cm, obscurely 3–5-lobed or palmatifid, lobes obtuse with entire to dentate margins, glabrous to tomentose, coriaceous, 5-nerved at the base, nerves soft hairy beneath. Figs (fruit) 2–5 cm in diameter, axillary, solitary or paired, obovoid to pyriform, sessile to subsessile or pedunculate, subtended by 3–4 deltoid bracts, green, ripening yellow-brown to brown-purple; ostiole with imbricate bracts.

*Flowering and fruiting*: July to October.

*Distribution and habitat*: Cultivated throughout Oman, in date and lime gardens. Occasionally found as an escape but always present near habitation. *Altitude*: 0–1000 m. Cultivated throughout SW Asia, N Africa and S Europe. Naturalised in many warm countries. Cultivated throughout the Arabian Peninsula.

*Distribution map*: Fig. 14. *Illustration*: Plate 16.

*Notes*: In Oman the fruit is eaten as a general tonic, laxative and diuretic. It is often prescribed by traditional healers for kidney problems.

2. *Ficus palmata* Forssk., Fl. Aegypt.-Arab. n. 623, p. 179 (1775).

subsp. *palmata*

*Synonyms*: *Ficus morifolia* Forssk. (1775).

*Vernacular names*: bols (Jibbālī), ēlos (Jibbālī); isqab, siqab, thiqab.

*Description*: Small tree or shrub, up to 4 m. Bark smooth, white. Latex white. Leaves variable in shape, but generally ovate to 3-lobed, 3–10 × 2–6.5 cm, apex rounded to acute, base truncate to subcordate, margin coarsely dentate to irregularly dentate, pubescent-scabrid, 3-nerved at the base; petioles up to 4 cm; stipules caducous. Peduncles up to 1.5 cm. Figs 1–2, in the axils of leaves, c. 2.5 cm in diameter, globose to pyriform, pubescent, pink-purple when ripe; ostiole round, with several visible imbricating bracts.

*Distribution and habitat*: Northern and southern Oman, on rocky slopes, in wadis in the foothills at low altitudes, often by permanent pools of water. Also in cultivated date gardens. *Altitude*: 150–1000 m. Distributed in northeast tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 15.

*Flowering and fruiting*: May to November.

*Notes*: The wild fig is common in cultivated date gardens. It is a very variable species, especially in the leaf characters and often difficult to tell apart from the cultivated fig. The rough, scabrid leaves are used as a scourer or an abrasive in some parts of northern Oman. The figs



are edible. The name of this species is based on material collected from Yemen (N) by P. Forsskal 781 (C).

3. *Ficus johannis* Boiss., Diagn. Pl. Or. Nov. ser. 1, 1 (7): 96 (1846).

*Synonyms*: *Ficus persica* Boiss. (1846); *Ficus geraniifolia* (1848).

*Vernacular names*: diqām.

*Description*: A large shrub or a small tree, up to 8 m, deciduous. Bark smooth, grey-white. Latex white. Leaves variable in size and lobation, 5–8 × 4–7 cm, palmately 3–5-lobed, sometimes deeply palmately 3–5-lobed with each linear lobe further dissected irregularly, rarely lobation obscure, apex acute to rounded, base truncate or cordate, margin obscurely dentate to serrate, sinuate, 3–5 nerved at the base, scabrous to smooth, coriaceous; petiole 3–25 mm. Peduncles 5–20 mm, subtended by a whorl of 3 bracts. Figs 1–2, in the axils of leaves, 10–12 mm in diameter, pyriform to subglobose, pubescent, green, ripening pale-purple; ostiole round, with many bracts.

*Description and habitat*: Northern Oman, Musandam, on the mountains, on rocky slopes and cliffs and in gorges. Not common. *Altitude*: 350–1800 m. Distributed in Iran, SW Pakistan, Afghanistan and adjacent regions of Central Asia. Elsewhere in the Arabian Peninsula found on the mountains which lie adjacent to Musandam in the UAE.

*Distribution map*: Fig. 16. *Illustration*: Plates 17, 17a.

*Flowering and fruiting*: December to March.

*Notes*: A distinct tree easily recognised in the field by its white bark. The shoots are heavily grazed by goats and camels.

4. *Ficus sycomorus* L., Sp. Pl. 1059 (1753).

*Vernacular names*: gheydel (Zitani Arabic), gheyzeh (Zitani Arabic), ghizit (Jibbali), sawqam.

*Description*: Tree, up to 20 m, epiphytic when juvenile. Bark rough, grey-brown. Latex white. Leaves clustered at the ends of shoots, rarely lobed, 5–10 × 3.5–9.5 cm, broadly ovate to sub-orbicular, apex obtuse, base cordate to rounded, margin entire, scabrous to glabrous; petioles up to 7 cm; stipules amplexicaul, caducous. Peduncles up to 2 cm, with 3 basal bracts. Figs in clusters on the larger leafless branches and on trunk, 4–5 cm (when fresh), obovoid to sub-globose, puberulous to tomentose, orange-red when ripe; ostiole with many overlapping scales.

*Flowering and fruiting*: April; October, November.

*Description and habitat*: Northern Oman and Dhofar, in the mountains, in wadis, escarpment cliffs and rocky hillslopes, often found near springs and permanent water pools. *Altitude*: 500–1900 m. Distributed from the eastern Mediterranean regions to southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 17. *Illustration*: Plates 18, 18a.

*Notes*: A large tree, sometimes planted by villages. The fruit is edible.

5. *Ficus cordata* Ridley, J. As. Soc. Straits, lvii. 93 (1910)  
subsp. *salicifolia* (Vahl) C.C. Berg, Kew Bull. 43: 82 (1988).

*Synonyms:* *Ficus salicifolia* Vahl (1790).

*Vernacular names:* ʿayṭib (Jibbālī), ḥoṭībīb (Jibbālī) ṣībēch (Zufari Arabic, Jibbālī), lithab

*Description:* Tree or large shrub, up to 15 m, evergreen. Bark smooth, pale-brown. Leaves 4–14 × 2–4 cm, narrowly ovate to lanceolate, apex acute to acuminate, base cuneate to rounded, margin entire or obscurely undulate, glabrous and often glossy; petiole 1–5 cm. Peduncles up to 3 mm. Figs 1–3, in the axils of leaves, 5–7 mm in diameter, globose to subglobose, green, often with pale-green spots, orange-red to deep red when ripe.

*Flowering and fruiting:* May–July.

*Distribution and habitat:* Throughout Oman, in the foothills, upper altitudes of the northern and southern mountains, occurring in wadis, crevices of rocks and cliffs, by *afīlay* (water channels), permanent and seasonal water pools. Absent in the dry and sandy desert areas, but present in desert oases. *Altitude:* 50–2000 m. Distributed throughout Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 18. *Illustration:* Plates 20, 20a.

*Notes:* Of the native species of *Ficus* found in Oman, this is the commonest. Figs which fall in wadi pools are reported to be chewed by fish. Sap of leaves and crushed new leaves have been used in traditional medicine for healing bruised fingers and toes, and for removing warts. The name of this species is based on material collected from Yemen by P. Forsskal 780 (C).

Wild collected seed of this species is held at the Millennium Seed Bank, Royal Botanic Gardens, Kew, U.K.

6. *Ficus ingens* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 288 (1867).

*Synonyms:* *Ficus lutea* sensu auct., Miller & Morris (1988); Schwartz (1939), non Vahl (1805).

*Vernacular names:* qerfit, zirfit (Jibbālī).

*Description:* Shrub or small tree, up to 10 m. Bark grey-brown. Latex white. Leaves 9–20 × 3–8 cm, narrowly ovate to lanceolate to oblong-lanceolate, apex acute to acuminate, base cordate to truncate, margin entire, sinuate, glabrous; petioles 1–5 cm. Peduncle up to 4 mm, with 3 basal bracts. Figs 1–2, in the axils of leaves, c. 10 mm in diameter, globose, glabrous to tomentose, sessile or pedunculate, white to reddish-pink when ripe; ostiole round, with 3 bracts.

*Flowering and fruiting:* October.

*Distribution and habitat:* Southern Oman, Dhofar, on cliffs and rocky slopes and by streams in the escarpment mountains. *Altitude:* 200–1600 m. Distributed in tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 19.

7. *Ficus vasta* Forssk., Fl. Aegypt.-Arab. 179 (1775).

*Synonyms:* *Ficus socotrana* Balf. f. (1883).

*Vernacular names:* ṭayq (Jibbālī, Zufari Arabic), ṭiq (Jibbālī).

*Description:* Tree, up to 20 m, epiphytic when young. Bark smooth, white, often with reddish-brown aerial roots. Latex white. Leaves 12–16 × 11–15 cm, broadly ovate to suborbicular, apex acute to rounded with a short acute tip, base cordate, pubescent, becoming glabrous with age. 3–5-nerved at the base; petioles up to 10 cm. Figs 1–2, in the axils of leaves, sessile or pedun-



culate, with a whorl of tomentose bracts, caducous, 1–1.5 cm in diameter, globose to subglobose, glabrous to puberulous-tomentose, green with pale-green spots, turning reddish when ripe; ostiole 2-lipped.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment mountains, on rocky hill slopes, wadis and summit grasslands. Occasionally cultivated as an ornamental tree. *Altitude:* 450–1500 m. Distributed in E. and NE tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Socotra.

*Distribution map:* Fig. 20. *Illustration:* Plate 21.

*Notes:* One of the largest trees in Oman. The figs are edible and also eaten by livestock. Bark, underbark and latex have been used in traditional medicine in Dhofar. The latex is used for example to stop bleeding in wounds. The name of this species is based on material collected from Yemen (Al Hadiyah and Taizz) by P. Forsskal, dated 1763, s.n. (C).

Cultivated species

*Morus nigra* L. with black ripe fruits (black mulberry) and *Morus alba* L. with white to pale yellow ripe fruits (white mulberry) (vernacular Arabic name for both species ‘tūr’) are cultivated in Oman and may be naturalised in date orchards. Mulberry trees are also frequently cultivated in private and public gardens. *Illustration:* Plate 22.

11. Urticaceae

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Key to genera of Urticaceae in Oman

- A. Small epiphytic plants. Leaves opposite. . . . .1. *Pilea*
- A\*. Plants not epiphytic. Leaves alternate.
- B. Stipules absent . . . . .3. *Parietaria*
- B\*. Stipules present
- C. Flowers arranged on axillary receptacles; receptacles surrounded by an involucre of 2–8 bracts. Plants densely white-woolly, hairs hooked, not stinging4. *Forsskaolea*
- C\*. Flowers arranged in axillary clusters. Plants provided with stinging hairs. . . . .2. *Laportea*

## 1. *Pilea* Lindl.

About 250 species distributed in tropical and warm regions, but absent from Australia and New Zealand.

*Pilea tetraphylla* (Steud.) Blume, Mus. Bot. Lugd.-Bat., 2, 3-4: 50 (1856).

*Synonyms*: *Urtica tetraphylla* Steud. (1850); *Pilea quadrifolia* A. Rich. (1850).

*Description*: Dioecious. Epiphytic annual herb, up to 10 cm. Stems erect, pale green, sometimes suffused with pink. Leaves opposite, glabrous, the upper pairs close together and appearing whorled, 5–20 × 3–15 mm, ovate, apex acute or obtuse, base cuneate, margin crenate. Stipules connate. Flowers white, minute, in dense axillary panicles; male flowers in the axils of lower leaves, perianth of 2–4 segments, free; stamens 2–4; female flowers in terminal panicles, median lobe larger than the lateral lobes, stigma feathery. Achenes ± 0.7 mm, ovoid, compressed.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, on the wet escarpment mountains, in *Anogeissus dhofarica* woodland, on moist soil in small depressions and crevices of shaded boulders and tree trunks. *Altitude*: 200–1000 m. Distributed in tropical Africa and Madagascar. Not recorded elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 21. *Illustration*: Plate 23.

*Notes*: The material that I've collected was present in a small pocket of soil on a boulder. Also found on trees.

## 2. *Laportea* Gaudich.

About 50 species, pantropical, extending to the temperate regions of N America and E Asia.

*Laportea interrupta* (L.) Chew, Gard. Bull. Singapore 21: 200 (1965), & 25: 145 (1969).

*Description*: Monoecious. Annual herb, up to 50 cm. Stems erect. Leaves glossy green, 40–55 × 15–40 mm, ovate, margins dentate, pubescent with stinging hairs; petioles 2–5 cm, slender. Stipules connate. Flowers in small interrupted clusters, often bisexual, on slender axillary axes; calyx with rough white hairs; male flowers: perianth lobes unequal, c. 1 mm, hooded at the apex; female flowers: perianth lobes unequal; stigma 3-fid. Achene ovoid, 1.5–2 mm, laterally compressed, basally surrounded by the calyx, dispersed with the perianth.

*Flowering and fruiting*: September, October (after monsoon rains).

*Distribution and habitat*: Southern Oman, Dhofar, on the wet escarpment mountains, in *Anogeissus dhofarica* woodland, in shaded and moist locations, often near pools of permanent water. *Altitude*: 200–1000 m. Distributed in the Old World tropics. Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 22. *Illustration*: Plate 24.

*Notes*: The species is likely to be present in the Mahra region of eastern Yemen.



3. *Parietaria* L.

About 10 species, distributed in the tropics, subtropics and the warm temperate regions.

*Parietaria alsinifolia* Delile, Descr. Egypte, Hist. nat. 137 (1813).

*Description:* Monoecious and bisexual annual herb, up to 20 cm. Stems weak, branching from the base, ascending, puberulous with white hairs. Leaves alternate, 5–15 × 4–11 mm, ovate to suborbicular, apex acute or obtuse, base rounded, margin entire, white-pubescent; petioles filiform, 5–10 mm. Stipules absent. Flowers yellow, female and bisexual, in cymose clusters, the upper clusters with female flowers, the lower clusters with male flowers. Involucral bracts 3, ovate-cordate, enlarging and enclosing the female flowers in fruit. Bisexual flowers: perianth cap-shaped, lobes c. 2 mm, oblong, papillose to glabrous; female flowers with smaller lobes, c. 1 mm, white-hairy. Achenes about 1 mm, ovoid, glossy black-brown, enclosed in the membranous bracts.

*Flowering and fruiting:* January to March, April.

*Distribution and habitat:* Northern Oman, in Musandam and lower altitudes of Jebel Akhdhar in the Hajar mountains, in wadis under trees and rock overhangs, and in crevices; also in irrigated and moist disturbed places. *Altitude:* 0–1800 m. Distributed in N. Africa, SW Pakistan, Afghanistan, SW Russia. In the Arabian Peninsula distributed in Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 23

*Note:* Miller & Cope (1996) record that the bracts are variable in size and shape from being linear-lanceolate to broadly ovate often with a distinct cordate base. Material from Khasab (Musandam) has linear lanceolate bracts which comes closest to *P. lusitanica* L., recorded from NE Pakistan, but more collections are needed to confirm the status of this species in Oman.

4. *Forsskaolea* L.

6 species, distributed in the Canary Islands, SE Spain, Africa, and Arabia.

- A. Leaves densely rough white-pubescent, grey-green beneath . . . . . 1. *F. tenacissima*  
A\*. Leaves glabrous to sparsely woolly beneath, green beneath . . . . . 2. *F. viridis*

1. *Forsskaolea tenacissima* L., Opobalsamum 18 (1764).

*Synonyms:* *Caidbeja adhaerens* Forssk. (1775).

*Vernacular names:* lazāq, lizaygah, malzāq, maṭābiqah, ṭubāq, ṭubayq.

*Description:* Monoecious. Annual or short-lived perennial, up to 60 cm. Stems woody below, erect or ascending, branching profusely, densely hairy with white-woolly and rigid hooked hairs, sticking to clothing etc. Leaves alternate, 9–25 × 5–20 mm, broadly obovate to rhombic, apex acute, base tapering into the petiole, margin serrate, densely rough white-pubescent, grey-green on the under surface, petioles 1–2 mm. Stipules connate. Flowers arranged on axillary receptacles, receptacles surrounded by an involucre of 2–8 bracts; female flowers surrounded by 4–8 male flowers. Involucral bracts 5–6 mm, densely white-woolly; male flowers: perianth 3-lobed, stamen 1; female flowers: perianth absent; stigma filiform. Fruits enclosed in an involucre of bracts; bracts c. 4 mm, densely hairy.

*Flowering and fruiting:* January to March/April.

*Distribution and habitat:* Throughout northern and southern Oman, on rocky hill slopes, in disturbed places, by roadside or open cultivated places. Common. *Altitude:* 0–1800 m.

Distributed in SW Europe, SW Asia, N and NE Africa. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 24.

**2. *Forsskaolca viridis* Webb., Hook. f., Niger. Fl. 179 (1849).**

*Description:* Monoecious. Annual herb, up to 60 cm. Stems erect or ascending, pubescent to white-woolly, with hooked hairs. Leaves alternate, 9–50 × 5–20 mm, broadly obovate to rhombic, apex acute, base tapering into the petiole, margin serrate, glabrous to sparsely woolly beneath, green; petioles 10–11 mm. Stipules connate. Flowers similar to *E. tenacissima*. Involucral bracts 3–8 mm, ovate to broadly ovate, hairs rigid at the base; bracts becoming membranous in fruit and enclosing the fruit.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, in wadis in shaded places, rocky slopes and under rock overhangs. *Altitude:* 10–500 m. Distributed in tropical and NE Africa, Cape Verde Islands. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 25.

*Notes:* The species is not commonly recorded from Oman but being an annual it is perhaps under-collected. So far not recorded from northern Oman.

## 12. Phytolaccaceae

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### ***Gisekia* L.**

5 species, distributed in tropical and subtropical Asia, and Africa, in dry, sandy habitats.

***Gisekia pharnaceoides* L., Mant. pl. 2: 562 (1771).**

*Synonyms:* *Pharnaceum occultum* Forssk. (1775).

*Description:* Short-lived annual herb, up to 10 cm. Stems prostrate to decumbent, branching from the base, glabrous, often tinged pink. Leaves opposite, 10–20 × 4–6 mm, obovate, apex obtuse or acute, base tapering into a short petiole. Flowers small, white, in sessile umbellate clusters in the axils of leaves and lateral shoots; sepals, c. 2 mm, ovate; petals absent; stamens 5. Fruit (achene) ± 1 mm, papillose.

*Distribution and habitat:* Northern and central Oman, in sandy and silty places, low sand dunes, irrigated and cultivated places. *Altitude:* 20–650 m. Distributed in Africa, Palestine, SW Asia, Mascarenes. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.



Distribution map: Fig. 26.

Flowering and fruiting: March, April.

Notes: A common ephemeral in sand, coming up after rain. The leaves and stems are often pink-green in colour.

13. Nyctaginaceae

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Key to the genera of Nyctaginaceae in Oman

- A. Plants herbaceous. Fruits 5 ribbed, glabrous or pubescent or glandular. . . .1. **Boerhavia**
- A\*. Plants often woody towards the base. Fruits obscurely 10-ribbed, covered with wart-like viscid glands. . . . .2. **Commicarpus**

1. **Boerhavia** L.

About 20 species, distributed in the warm regions of the world.

- A. Stems leafy, not branching dichotomously, green. Anthocarp 3–4 mm, ellipsoid, puberulous, with small yellow glands on the ribs . . . . .1. **B. diffusa**
- A\*. Stems not leafy, branching dichotomously magenta-red. Anthocarp 2.5–3 mm, clavate, glabrous on the ribs, puberulous in between . . . . .2. **B. elegans**

1. *Boerhavia diffusa* L., Sp. Pl. 3: 1753.  
*Synonymy*: *Boerhavia arcuata* Willd. (1797); *B. coccinea* Miller (1768); *Boerhavia repens* L. var. *diffusa* (L.) Hook. (1885); *B. repens* var. *viscosa* Choisy in DC. (1849).  
*Vernacular names*: hadimdām, sunajid, sunayid.

*Description*: Perennial or annual herb. Stems erect to ascending, sometimes up to 1 m, woody at the base, with long internodes. Leaves opposite, green tinged red with a pink margin, 13–20 × 11–20 mm, broadly ovate, apex acute to obtuse, base rounded to truncate, margins sinuately lobed, young leaves pubescent and ciliate with septate hairs, older leaves glabrous. Flowers in axillary cymes, the ultimate flowers in umbels, pedicels delicate. Flowers pink to magenta,  $\geq$  1.5 mm including the ovary; calyx pubescent on the outside. Anthocarp 3–4 mm, ellipsoid, 5-ribbed, puberulous, with small yellow glands on the ribs.

Flowering and fruiting: March; September, October.

*Distribution and habitat:* Northern and southern Oman, in sandy and gravelly locations, wadi beds and rocky slopes. Also found near cultivated land and farms and by roadsides. *Altitude:* 0–2000 m. Pantropical. Elsewhere in the Arabian Peninsula distributed in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 27.

*Notes:* A common plant growing in a wide variety of habitats. Variations are present in the size and shape of leaves, and compactness of inflorescence.

## 2. *Boerhavia elegans* Choisy, Prodrumus 13(2): 453 (1849).

*Type:* [Oman], Mascate, *Aucher-Eloy* 5251 (syntypes BM, G, K, P).

*Synonyms:* *Boerhavia rubicunda* Steud. (1840) nom. nud.; *B. repens* L. var. *elegans* (Choisy) Asch. & Schweinf. (1867); *B. elegans* Choisy var. *stenophylla* Boiss. (1879), lectotype, Pakistan, Baluchistan, 1851, Stocks (G-Boiss.), lectotype chosen by Fosberg (1978); *B. rubicunda* Steud. var. *stenophylla* (Boiss.) Forberg (1978); *B. elegans* Choisy subsp. *stenophylla* (Boiss.) A.G. Miller (1994).

*Vernacular names:* hadimdām, sulaykit mal jebel.

*Description:* Perennial or annual herb, up to 40 cm, with a woody rootstock. Stems magenta-red, erect, slender, branching dichotomously. Leaves basal, 20–40 × 7–15 mm, oblong to obovate, reddish-green and with red sinuate margins; petioles up to 10 mm. Flowers in lax, delicate panicles. Perianth 2–3 mm, red-purple; pedicels 15 mm, delicate. Anthocarp 2.5–3 mm, clavate, 5-ribbed, glabrous on the ribs, puberulous in between.

*Flowering and fruiting:* September to May.

*Distribution and habitat:* Throughout Oman, common by roadsides and wadi beds, amongst gravel and stones. *Altitude:* 50–800 m. Distributed in NE and E Africa, Iran, SW Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 28. *Illustration:* Plates 25, 26.

*Notes:* A very distinct plant with delicate magenta to purple-red stems, appearing as a red-haze where it grows. Grazed by camels and goats. I have not recognized var. or subsp. *stenophylla* here as in Miller (1994) in *Edinb. J. Bot.* 51(1): 40 and 1996, op. cit., as I have not been able to find good characters to separate the two taxa. Miller based his subspecies on the original syntype from Oman (see synonymy), apparently not aware of the lectotypification by Fosberg.

In addition to the above two species in Oman, possibly *B. repens* L. is also found there. This is a pantropical weed, distinguished by its axillary inflorescences, white to pale-pink flowers, narrow lanceolate to ovate leaves, and the absence of long septate hairs.

## 2. *Commicarpus* Standley

About 27 species, distributed throughout the tropics, but mainly NE Africa.

- A. Stems glandular-pubescent, sticky to touch. [Anthocarp fusiform with stalked glands at the apex and sessile below] . . . . . 1. *C. stenocarpus*
- A\*. Stems pubescent or glabrous, not sticky
  - B. Anthocarp clavate
    - C. Leaves ovate. Apical glands sessile. . . . . 2. *C. boisseri*
    - C\*. Leaves broadly ovate to orbicular. Apical glands stalked. . . . . 4. *C. mistus*
  - B\*. Anthocarp turbinate. [Anthocarp with dark-purple wart-like glands] . . . 3. *C. helenae*



1. *Commicarpus stenocarpus* (Chiov.) Cufod., Enum. Pl. Aeth. 81 (1953).

*Synonyms*: *Boerhavia stenocarpa* Chiov. (1929).

*Vernacular names*: aytif (Jibbālī, and also used for other *Commicarpus* spp.).

*Description*: Perennial subshrub, stems up to 50 cm, arising from a woody base. Stems and branches glandular-pubescent with crisp hairs below; stems sticky to touch. Leaves opposite, 10–25 × 8–25 mm, ovate to suborbicular or obcordate, margins sinuate. Flowers in superposed umbels, 3–5 per node; pedicels 1–4 mm; perianth pink-purple, 5–8 mm, narrowly funnel-shaped, base enclosing the ovary, persistent; stamens 3. Anthocarp fusiform, yellow-brown, 6–7 mm, glands stalked at the apex, sessile on the ribs.

*Flowering and fruiting*: February to April; September to October.

*Distribution and habitat*: Northern and central Oman and Dhofar, and Halamiyah Island, on rocky hillsides, scree slopes and rocky coastal areas, wadi banks and wadi beds. Common. *Altitude*: 0–850 m. Distributed in NE Africa, Iran, SW Pakistan. In the Arabian Peninsula present only in Oman.

*Distribution map*: Fig. 29. *Illustration*: Plate 27.

2. *Commicarpus boissieri* (Heimerl.) Cufod., Enum. Pl. Aeth. 79 (1953).

*Synonyms*: *Boerhavia boissieri* Heimerl. (1907).

*Vernacular names*: aytif, ḥaṭif, 'iṭif (Jibbālī).

*Description*: Perennial herb with a woody base. Stems slender, straggling, up to 1 m, glabrous. Leaves opposite, 20–60 × 10–60 mm, ovate, fleshy, with red, sinuate margins. Flowers in superposed umbels, 3–5 per node; pedicels 6–15 mm; perianth 4–5 mm, pinkish-green, violet or white, funnel-shaped, base enclosing the ovary, persistent; stamens 3. Anthocarp 5–7 mm, clavate, reflexed, with sessile glands forming a ring at the apex and on the ribs below.

*Flowering and fruiting*: February to April; September.

*Distribution and habitat*: Throughout Oman, in gravel and sandy wadi beds and dry rocky hillsides. *Altitude*: 50–1000 m. Distributed in Pakistan, India. Not found elsewhere in the Arabian Peninsula. Also distributed in Soqatra.

*Distribution map*: Fig. 30.

*Notes*: The name of this species is based on material collected from Baluchistan (Pakistan), by G.E. Stocks (K). The plant is heavily grazed by livestock.

3. *Commicarpus belenae* (Roemer & LA. Schultes) Meikle in Hooker's, Ic. Pl. 37: t. 3694 (1971).

*Synonyms*: *Boerhavia belenae* Schultes (1822).

*Vernacular names*: aytif, ḥaṭif, 'iṭif (Jibbālī).

*Description*: Perennial subshrub. Stems straggling, young shoots puberulous. Leaves grey-green, opposite, 12–40 × 10–20 mm, broadly ovate to suborbicular, margins sinuate; petioles up to 5 cm long. Flowers in lax inflorescence, 3–5 per node, in superposed umbels; perianth pale pink or purple, 1.5–3 mm, widely funnel-shaped; sessile or shortly pedicellate; stamens 2. Anthocarp 5–7 mm, turbinate, with wart-like glands at the apex and below; glands dark purple.

*Flowering and fruiting*: February to April; September.

*Distribution and habitat:* Northern and Southern Oman, on hillsides, trailing on stones and rocks; also found in cultivated areas. *Altitude:* 50–1800 m. Distributed in tropical Africa, Egypt, Palestine, Iran, Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 31. *Illustration:* Plate 28.

*Notes:* Very similar to *C. boissieri* but distinguished by the sessile or shortly pedicellate flowers, 2 stamens and dark-purple glands on the anthocarp.

3. *Commicarpus mistus* Thulin in Nord. J. Bot. 10 (4): 405 (1990).

*Synonyms:* *Commicarpus squarrosus* sensu auct., non Heimerl

*Description:* Perennial subshrub or herb with a woody base, up to 40 cm. Stems straggling to ascending, grey-green, crisp-pubescent towards the base. Leaves 10–35 × 15–40 mm, broadly ovate to orbicular, fleshy, base truncate or subcordate, margins sinuate. Flowers in superposed umbels, 3–6 per node, purple; perianth 5–6 mm, narrowly funnel-shaped, puberulous; stamens 2–3. Anthocarp 4–5 mm, clavate, with stalked glands at the apex and sessile wart-like glands below the ribs, pubescent.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in gravel and stony wadi beds and rocky hillsides straggling over rocks. *Altitude:* 500–1800 m. Distributed in NE and E Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 32. *Illustration:* Plate 29.

## 14. Aizoaceae

(including Molluginaceae)

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### Key to the genera of Aizoaceae in Oman

- A. Capsule opening by valves
  - B. Capsule dehiscing by 5 valves
    - C. Stems erect to ascending. Sepals free. Stamens free .....1. *Corbichonia*
    - C\*. Stems prostrate to ascending. Sepals united, 5-lobed. Stamens united in bundles. ....3. *Aizoon*
  - B\*. Capsule dehiscing by a 2-valved lid .....5. *Zaleya*
- A\*. Capsule circumsessile or opening by an apical slit



- D. Herbs glabrous, not covered with papillae. Deliscence of capsule circumsessile. Petaloid stamens absent. . . . .2. **Trianthema**
- D\*. Herbs covered with shining papillae. Deliscence of capsule by a star-shaped slit. Petaloid stamens many. . . . .4. **Mesembryanthemum**

1. **Corbichonia** Scop.  
2 species, distributed in SW Africa and tropical Africa to Asia.

*Corbichonia decumbens* (Forssk.) Exell in J. Bot. 73: 80 (1935).  
*Synonyms:* *Orygia decumbens* Forssk. (1775).

*Description:* Annual herb. Stems up to 40 cm, erect to ascending, glabrous, rigid and wiry, often tinged red. Leaves alternate, fleshy, glabrous, 10–22×6–11 mm, ovate to obovate-spatulate, apex apiculate, base cuneate, margins entire; petioles 1–4 mm. Flowers pink, in few- many-flowered leaf-opposed or terminal cymes; sepals 4–8 mm, petaloid; petals absent; staminodes many, in 2 whorls, petaloid; stamens free. Capsule 5–6 mm, globose, dehiscing by 5 valves. Seeds strophiolate, black.

*Flowering and fruiting:* March to April; July–September. After rain.

*Distribution and habitat:* Northern Oman and Dhofar, in sandy areas, wadi beds and low, stony slopes, coming up after the rains. *Altitude:* 0–1200 m. Distributed in the drier parts of tropical N. Africa, Iran, Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 33.

*Notes:* Not common, but perhaps under-collected. The flowers open late in the afternoon. The name of this species is based on material collected from Yemen by P. Forsskal (holotype K, isotype BM).

2. **Trianthema** L.  
About 17 species, distributed in the tropics and subtropics.

- A. Herbs with procumbent to ascending stems. Leaves 6–20 mm wide, suborbicular to obovate. Stamens 10–15. . . . .1. **T. portulacastrum**
- A\*. Herbs with prostrate stems. Leaves 1–4 mm wide, cylindric to lanceolate to oblanceolate. Stamens 5. . . . .2. **T. triquetra**

1. *Trianthema portulacastrum* L., Sp. Pl. 223 (1753).  
*Synonyms:* *Trianthema monogyna* L. (1767).

*Description:* Annual herb. Stems up to 50 cm, branched, somewhat succulent, procumbent to ascending, spreading. Leaves opposite, unequal in the pair, fleshy, 15–25×6–20 mm, suborbicular to obovate, base clasping and united with that of the opposite leaf; petioles 2–20 mm; stipules present. Flowers solitary, axillary, sessile; calyx-lobes 2–3 mm, pink to white, apiculate; stamens 10–15, inserted on the calyx-tube. Capsule 3–5-seeded, with a flattened lid, rim raised; dehiscence circumsessile.

*Flowering and fruiting:* September to April.

*Distribution and habitat:* Southern Oman, Dhofar, in cultivated and irrigated places and date gardens. Often weedy. *Altitude:* 0–100 m. A pantropical weed, distributed in tropical America, W Asia, Sri Lanka. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 34.

*Notes:* The species is recorded to be uncommon in Saudi Arabia (Collenette 1999).

2. *Trianthema triquetra* Willd., Ges. Naturf. Fr. Berlin Neue Schriften 4: 181 (1803).

*Description:* Annual herb or short-lived perennial, up to 50 cm. Stems succulent, branched, prostrate, ringed red. Leaves 1–20×1–4 mm, cylindric to lanceolate to oblanceolate or obovate, apex rounded to apiculate, base clasping. Flowers white to pink, 2–3, axillary, sessile; calyx lobes ± 1 mm, each with a subapical mucro; stamens 5. Capsule (pyxidium) ± 2 mm, flattened at the top in the centre.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, in shaded and sandy soils, particularly on coasts and by roadsides. *Altitude:* 0–600 m. Distributed in N Africa, SW Asia from Iran to Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 35.

3. **Zaleya** Burm.f.

6 species, distributed in the Old World tropics, Australia.

*Zaleya pentandra* (L.) Jeffery, Kew Bull. 14 (2): 238 (1960).

*Synonyms:* *Trianthema pentandra* L. (1767).

*Description:* Annual or perennial herb, up to 30 cm. Stems prostrate to decumbent, somewhat succulent, glabrous to minutely papillose. Leaves opposite, 10–25×8–17 mm, ovate to elliptic, apex obtuse; petiole expanding at the base, forming scarious wings. Flowers pale pink, in axillary clusters; calyx c. 2 mm, lobes with white hyaline margins; petals absent; stamens 5. Capsule 1.5–2 mm, globose, depressed above, reddish-brown, dehiscing by a 2-valved lid.

*Flowering and fruiting:* September to July.

*Distribution and habitat:* Southern and northern Oman in Dhofar and the Batinah, in cultivated and irrigated areas and on disturbed ground. *Altitude:* 20–1800 m. Distributed in tropical Africa, Palestine, Madagascar. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 36.

*Notes:* The species is based on seed material collected by P. Forsskal in Yemen and cultivated at Uppsala.

4. **Aizoon** L.

25 species, distributed in the Mediterranean region, N and S Africa, Australia.

- A. Stems prostrate, somewhat zigzag. Leaves spatulate. Capsule valves not recurving at dehiscence ..... 1. **A. canariensis**
- A\*. Stems ascending, not prostrate. Leaves oblong to linear-lanceolate. Capsule valves recurving at dehiscence ..... 2. **A. hispanicum**



1. *Aizoon canariensis* L., Sp. Pl. 488 (1753).

*Synonyms:* *Glinus chrySTALLINUS* Forssk. (1775).

*Description:* Annual or short-lived perennial, densely to sparsely pilose. Stems prostrate, arising from a woody base, somewhat zigzag, up to 20 cm. Leaves alternate or subopposite, 10–30 × 5–11 mm, grey-green, spatulate, apex rounded to subacuminate, base attenuating into the petiole; petiole 5–14 mm. Flowers borne in the forks of branches, white to pale yellow, up to 4 mm wide, solitary, sessile; sepals 3–5 mm, 5-lobed, with a white-hyaline margin, pubescent; petals absent; stamens many, arranged in groups (5 bundles). Capsule c. 5 mm in diameter, 5-angled, star-shaped, flattened at the top, valves not recurving at dehiscence.

*Flowering and fruiting:* February to April; September to October. Flowering after rain.

*Distribution and habitat:* Throughout Oman and including the offshore islands, Halaniyah, Dumaniyah and Masirah. Found in most habitats (sandy, gravelly and rocky areas). Also found in irrigated fields, and on waste and disturbed ground. A common annual coming up after rain, found commonly under *Acacia tortilis* trees. *Altitude:* 0–1800 m. Distributed in tropical and S Africa, Palestine, Canary Islands, E and W Mediterranean, Iraq, Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 37. *Illustration:* Plate 30.

2. *Aizoon hispanicum* L., Sp. Pl. 488 (1753).

*Description:* Annual herb, papillose throughout. Stems branched, ascending, up to 15 cm. Leaves opposite to subopposite, grey-green, 20–30 × 5–8 mm, oblong to linear-lanceolate, apex obtuse, sessile or base attenuating into a subsessile petiole. Flowers axillary, white, up to 1.5 cm across, solitary, sessile; sepals 8–10 mm, 5-lobed, lobes triangular, tip acute, green; stamens many, in bundles. Capsule 5-angled, 5–6 mm in diameter, flattened at the apex, valves recurving at dehiscence.

*Flowering and fruiting:* September.

*Distribution and habitat:* Northern Oman, Musandam, coastal, in sandy and gravelly places. *Altitude:* 0–250 m. Distributed in Iraq, Iran, N Africa, Palestine and the Mediterranean region. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia.

*Distribution map:* Fig. 38.

*Notes:* Not common in Oman, but perhaps under-collected. So far recorded only from Musandam. Collection of whole plants should be discouraged until additional distribution records are confirmed.

5. *Mesembryanthemum* L.

70 species, distributed in the Mediterranean region, drier parts of S and N Africa, S Australia, California, Atlantic Islands.

*Mesembryanthemum nodiflorum* L., Sp. Pl. 480 (1753).

*Synonyms:* *Chlorophytum nodiflorum* L. (1753).

*Description:* Annual herb. Stems branched, up to 5 cm, ascending, somewhat succulent, covered with shiny papillae. Leaves opposite or subopposite, 10–20 × 2–4 mm, terete, fleshy, ciliate at the base. Flowers white, axillary, calyx with linear, fleshy lobes; petaloid staminodes more than 20, white or cream, shorter than the calyx-lobes. (Capsule 5–8 mm, not seen).

*Flowering and fruiting:* ?March to April.

*Distribution and habitat:* Northern Oman, recorded only from Musandam, coastal on sandy and silty areas. *Altitude:* 0–250 m. Distributed in N. Africa, Syrian desert, Mediterranean region, Turkey and Iraq. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 39.

*Notes:* Not common in Oman and perhaps under-collected. Collection of whole plants should be discouraged from the recorded site until additional distribution records are confirmed.

## 15. Chenopodiaceae

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### Key to the genera of Chenopodiaceae in Oman

(Adapted from Boulos, 1996)

- A. Stems jointed, leafless or with inconspicuous scale-like opposite leaves
  - B. Succulent coastal plants. Fruiting perianth without wings.
    - C. Leaves succulent, scale-like. Flowers in small cone-like spikes. . . .7. **Halocnemum**
    - C\*. Leaves absent or reduced to short extensions of the joints. Flowers in elongated spikes. . . . .8. **Arthrocnemum**
  - B\*. Desert shrubs. Fruiting perianth with wings.
    - D. Perennial shrubs up to 50 cm. Perianth without fleece bundles within. Seed horizontal. . . . .11. **Haloxylon**
    - D\*. Annual herbs, up to 30 cm. Perianth with two fleece bundles within. Seed vertical. . . . .15. **Anabasis**
- A\*. Stems not jointed, leafy with the leaves usually conspicuous
  - E. Leaves broad and flat



- E. Coastal plants. Fruit enveloped in the bracteoles. . . . .3. **Atriplex**
- E\*. Plants not coastal. Fruit not enveloped in the bracteoles.
  - G. Fruits connate at the base in clusters of 2–4. Fruiting perianth indurate 2. **Beta**
  - G\*. Fruits separate, utricles with a membranous pericarp. Fruiting perianth herbaceous . . . . .1. **Chenopodium**
- E\*. Leaves narrow, subulate, linear, globose or semi-globose
  - H. Leaves spine-tipped
    - I. Leaves with tufts of white woolly hairs in the leaf axils . . . . .10. **Cornulaca**
    - I\*. Leaves without tufts of white woolly hairs in the leaf axils
      - J. Leaves linear, 1–5 cm, parallel-veined . . . . .4. **Agriophyllum**
      - J\*. Leaves not linear 2–8 mm, not parallel-veined . . . . .12. **Salsola**
  - H\*. Leaves not spine-tipped
    - K. Fruiting perianth with conspicuous membranous wings, the wings indurate in fruit . . . . .13. **Halothamnus**
    - K\*. Fruiting perianth without conspicuous wings
      - L. Leaves globose, perfoliate, stems appearing jointed . . . . .6. **Halopeplis**
      - L\*. Leaves not globose, stems not appearing jointed
        - M. Leaves densely villous. Perianth lobes white woolly. . . . .5. **Bassia**
        - M\*. Leaves not densely villous. Perianth lobes not white woolly.
          - N. Leaf bases constricted and soon becoming indurate. Perianth tube usually well developed . . . . .14. **Sevada**
          - N\*. Leaves bases never indurate. Perianth tube inconspicuous . .9. **Suaeda**

1. **Chenopodium** L.

About 150 species, distributed mainly in temperate regions.

- A. Most leaves with irregularly dentate margins. Plants not smelling unpleasantly
  - B. Plant mealy-white to grey-farinoso. Seeds slightly keeled along the margin . . . . .1. **C. album**
  - B\*. Plant not mealy-white to grey-farinoso. Seeds strongly keeled along the margin . . . . .2. **C. murale**
- A\*. Leaves with entire margins. Plants smelling unpleasantly of rotting fish . .3. **C. vulvaria**

1. *Chenopodium album* L., Sp. Pl. 219 (1753).

*Description.* Annual herb, up to 20 cm. Stems branched, erect to ascending, ridged or angled, mealy-white to grey-farinoso, or tinged red. Basal leaves 10–80×10–50 mm, deltoid to lanceolate, upper leaves lanceolate to ovate, apex acute or obtuse, margins irregularly dentate or sometimes entire, sinuate, leaves white-mealy on the undersurface, petioles 10–30 mm. Inflorescences mealy. Flowers small, in dense, paniculate, terminal and axillary clusters; perianth segments 5, free to the base, keeled, with membranous margins, stamens 5. Fruit globose with a membranous pericarp. Seeds black, glossy, slightly keeled along the margin.

*Flowering and fruiting:* February, March.

*Distribution and habitat:* Northern Oman, in wadis and plains, in moist, open and disturbed ground and irrigated areas. Weedy. *Altitude:* 0–200 m. Cosmopolitan in distribution. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

*Distribution map:* Fig. 40.

*Notes:* Grazed by goats and camels.

2. *Chenopodium murale* L., Sp. Pl. 219 (1753).

*Vernacular names:* ḍorbaiḥ, zorbaiḥ.

*Description:* Annual herb, up to 30 cm. Stems erect, sparsely branched, angular, ridged, dark-green, glabrous. Leaves 7–32 × 4–19 mm, rhombic to rhombic-ovate to ovate, apex acute or obtuse, base tapering into a slender petiole, margins irregularly and coarsely dentate; petioles 5–20 mm. Flowers small, in terminal and axillary cymes; perianth segments 5, connate to a third of their length; keeled, with narrow membranous margins; stamens 5. Fruit globose with a membranous pericarp, adhering to the seed. Seeds black, glossy, keeled along the margin.

*Flowering and fruiting:* September to April.

*Distribution and habitat:* Throughout Oman, in disturbed and irrigated places. A common weed of disturbed and irrigated land. *Altitude:* 0–600 m. Cosmopolitan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 41. *Illustration:* Plate 31.

*Notes:* Grazed by all animals. A cosmopolitan weed, common throughout Oman, in moist, irrigated and waste places.

3. *Chenopodium vulvaria* L., Sp. Pl. 220 (1753).

*Description:* Annual herb, up to 40 cm, with an unpleasant smell. Stems erect, ridged or angled, branched, mealy, smelling unpleasantly of rotting fish. Leaves 7–25 × 5–20 mm, grey-mealy, rhombic-ovate to ovate, apex acute or obtuse, margins entire, sometimes with 2 lateral lobes near the base; petioles 5–15 mm. Flowers small, in terminal and axillary cymes. Perianth segments 5, fused at the base, not keeled, densely mealy; stamens 1–5, absent in female flowers. Fruit globose, with a membranous pericarp. Seeds black, glossy, slightly keeled along the margin.

*Flowering and fruiting:* March to May.

*Distribution and habitat:* Northern Oman, in the foothills of the Jebel Akhdhar range, in disturbed and irrigated places. *Altitude:* 1800–2300 m. Distributed in Europe, N Africa and Asia; introduced into N America and Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (N).

*Distribution map:* Fig. 42.

*Notes:* Not common in Oman and found at higher altitudes than the other two species.

2. **Beta** L.

6 species, Mediterranean and European in distribution.

*Beta vulgaris* L., Sp. Pl. 222 (1753)

subsp. *maritima* (L.) Arcang., Comp. Fl. Ital. 593 (1882).

*Synonyms:* *Beta maritima* L. (1753).

*Description:* Annual herb, up to 80 cm. Stems erect, ridged, branched, green or reddish. Basal leaves in a rosette; leaves 2–10 × 1–5 cm, somewhat succulent, glabrous, basal leaves ovate to ovate-cordate, cauline leaves ovate-deltoid, apex acute to apiculate, margins entire, sinuate, petioles 5–15 mm. Flowers in interrupted, leafy spikes. Perianth segments 5, fused at the base.



fleshy, indurate in fruit; stamens 5, placed at the rim of a perigynous disc; ovary fused to the receptacle and base of perianth. Fruit globose, fleshy or indurate. Seeds black, glossy, reticulate.

*Flowering and fruiting*: March to May.

*Distribution and habitat*: Northern and southern Oman, in moist, sandy and saline locations, on disturbed and irrigated places and edges of fields. *Altitude*: 350–2000 m. Distributed in W. Europe, Mediterranean region, W. Asia and Sri Lanka. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 43.

### 3. *Atriplex* L.

About 100 species, distributed in the warm and temperate regions of the world.

- A. Leaves oblong to ovate-oblong, auriculate at base ..... 1. *A. farinosa*
- A\*. Leaves broadly ovate, orbicular or deltoid-ovate, not auriculate at base
  - B. Fruiting bracteoles broadly ovate to cordate. Leaves broadly ovate to orbicular ..... 2. *A. stocksii*
  - B\*. Fruiting bracteoles deltoid, lobed or toothed. Leaves ovate-cordate to ovate-deltoid ..... 3. *A. leucoclada*

#### 1. *Atriplex farinosa* Forssk., Fl. Aegypt.-Arab. 123 (1775).

*Synonyms*: *Atriplex hastata* Forssk. (1775), non L.

*vernacular names*: 'afar.

*Description*: Shrub, up to 1.5 m. Stems erect, white to grey, densely mealy, branched with the branches spreading. Leaves alternate, 10–25 × 6–15 mm, oblong to ovate-oblong, auriculate at base, grey-green, mealy on both surfaces, lower leaves usually smaller; petioles 2–5 mm. Flowers in sessile clusters arranged in terminal panicles. Bracteoles 2–4 mm, suborbicular, lined below, reddish when young; perianth of male flowers lobed. Fruit enclosed in a pair of bracteoles.

*Flowering and fruiting*: October to February.

*Distribution and habitat*: Throughout the coastal areas of Oman, on sandy beaches and on edges of sea-milers, and on beaches of all offshore Islands. *Altitude*: Sea level. Distributed in NE tropical Africa, Jordan, Egypt. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 44. *Illustration*: Plate 32.

*Notes*: One of the common *Atriplex* shrubs on the coasts of Oman, including Halamiyah Island. It is abundant on the coasts of the Barr al Hikman peninsula (central Oman). The name of this species is based on material collected from Saudi Arabia by P. Forsskål 976 (lectotype C).

#### 2. *Atriplex stocksii* Boiss., Diagn. Pl. Or. Nov. ser. 2, (4): 73 (1859).

*Synonyms*: *A. griffithii* var. *stockii* (Boiss.) Boiss. (1879); *A. sokotranum* Vierh. (1903); *A. griffithii* Moq. subsp. *stocksii* (Boiss.) Boulos (1991).

*Description*: Dioecious. Perennial shrub. Stems up to 50 cm, erect, branched, bark white to grey, mealy when young. Leaves subopposite, sessile to shortly petiolate, with leaf fascicles. Lamina 5–15 × 6–15 mm, broadly ovate to orbicular, grey-green, mealy, apex rounded to retuse,

margin entire, undulate, base tapering into a short petiole; petiole 2–4 mm. Flowers in dense sessile clusters arranged in leafless terminal panicles, in the axils of leafy bracts. Bracteoles 2 in female flowers, c. 3 mm, with 0–2 appendages on each side, enlarging and enclosing the fruit; perianth 5-lobed; stamens 5.

*Flowering and fruiting*: September to November.

*Distribution and habitat*: Throughout the coastal areas of Oman and the beaches of the offshore Islands, on sandy beaches at tide line and on the banks of sea inlets. *Altitude*: Sea level. Distributed in Pakistan (Sind), NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 45.

*Notes*: Freitag et al. (op. cit. p. 58) state that *A. stocksii* is endemic to the coastal belt of the Arabian Sea. The species in Saudi Arabia and Yemen is very similar to this species and has been treated by Boulos (including Oman material) as a subsp. of *A. griffithii* Moq. (see Nord. J. Bot. 11: 310, 1991). I have followed Freitag et al. and have kept the Oman plants under *S. stocksii*, as *A. griffithii*, originally described from Afghanistan from Baiman, seems more to be an inland species.

In Oman *A. stocksii* often occurs with *A. farinosa*. The name of this species is based on material collected from Sind (Pakistan) by G.E. Stocks, no. 642 (holotype G DC, isotype K J).

### 3. *Atriplex leucoclada* Boiss., Diagn. Pl. Or. Nov. Ser. 1, 2(12): 95 (1853)

var. *inamoena* (Aellen) Zohary, Fl. Palaest. 1: 147 (1966).

*Synonyms*: *Atriplex inamoena* Aellen (1939).

*Vernacular names*: 'afar.

*Description*: Monoecious. Shrub, up to 1 m. Stems erect to spreading, white-grey, woody at the base. Leaves alternate, petiolate, 5–18 × 4–8 mm, ovate-cordate to ovate-deltoid, apex acute, base tapering into the petiole, margin sinuate, grey-green, mealy; petiole 0.5–1 cm. Flowers in axillary and terminal clusters of 3–10, unisexual, the axillary clusters female, terminal clusters bisexual. Fruiting bracteoles 3–5 mm, deltoid, lobed or toothed, fused below.

*Flowering and fruiting*: October to February.

*Distribution and habitat*: Northern Oman, on coasts and coastal cliffs, desert coastal wadi beds, on calcareous and saline soils. *Altitude*: 0–150 m. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 46. *Illustration*: Plates 33, 34.

*Notes*: Two varieties are recognized: the first, *A. leucoclada* var. *inamoena* has small, ovate-cordate leaves up to 1.5 cm long, and has a fruiting perianth with 5 apical lobes. This taxon is found in Bahrain, Kuwait, Oman, Saudi Arabia, Yemen, and the UAE. The second variety, *A. leucoclada* var. *turcomanica* (Moq.) Zoh., has larger, triangular-deltoid leaves, up to 3.5 cm, and a fruiting perianth that is quadrangular to campanulate. This taxon is found in all other countries of the Arabian Peninsula except Oman.

### Cultivated species

*Atriplex halimus* L. (1753).

Shrub up to 1.5 m with ovate to triangular grey-green leaves. Cultivated in Oman as a hedge plant. The species is salt tolerant and grows well in an arid climate.



4. *Agriophyllum* M. Bieb.

6 species, distributed in Europe; a single species in C Asia.

*Agriophyllum minus* Fisch. & Mey. ex Ledeb., Flora Ross. 3(2): 755 (1851).

*Synonymis*: *Agriophyllum montasirii* El-Gazzar (1988).

*Description*: Annual herb. Stems up to 15 cm, spiny, rigid, woody at base, branched, sparsely pubescent. Leaves 15–25 × 2–3 mm, lanceolate to linear-lanceolate, apex acute and somewhat sinuocrenate, base attenuating into a short petiole, venation of leaves parallel (appearing as a grass leaf). Flowers sessile, in dense clusters, in the axils of small spinescent bracts. Perianth scarious, included in the bracts. Fruit 4–5 mm, compressed; style persistent with 2 elongated wings at the apex.

*Flowering and fruiting*: March.

*Distribution and habitat*: Northern Oman, in shallow sand and on low sand dunes, on relatively saline, sandy soil. The species has been recorded from the western desert on the Oman–UAE border. *Altitude*: 100–150 m. Distributed in Iran and Iraq to C Asia. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE.

*Distribution map*: Fig. 47.

*Notes*: An Asian species with its southern most distribution in northern Arabia. Collected by Nancy Fitzgerald, in 1948 from Buraimi (Oman). Rare or very localised and perhaps under-collected in Oman. I have collected the species from western Oman on the Fahud–Lekhwar sabkhas, growing on low sand dunes. Like all other vegetation there, the species is very localized in its distribution and is not common.

5. *Bassia* All.

26 species, distributed in the warm regions of the world.

*Bassia muricata* (L.) Asch. in Schweinf., Beitr. Fl. Aethiop. 1: 187 (1867).

*Synonymis*: *Salsola muricata* L. (1767); *Kochia muricata* (L.) Schrad. (1809).

*Description*: Annual herb, densely villous. Stems erect, up to 30 cm, stems sometimes woody at the base. Leaves alternate, sessile, 5–15 mm, linear, white-villous. Male and female flowers mixed in axillary clusters on leafy spikes, perianth membranous, each perianth segment developing a spine at the apex in fruit, villous at the base; stamens 5.

*Flowering and fruiting*: February to May.

*Distribution and habitat*: Northern Oman, on sandy coastal areas, and disturbed land. *Altitude*: 0–50 m. Distributed in Africa, SW Asia eastwards to Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 48.

*Notes*: Apparently uncommon or under-collected in Oman.

## 6. *Halopeplis* Bunge ex Ung.-Sternb.

3 species, distributed in warm temperate regions of the Old World, and Europe.

*Halopeplis perfoliata* (Forssk.) Bunge ex Aschers in Schweinf., Beitr. Fl. Aethiop. 289 (1867).

*Synonyms*: *Salicornia perfoliata* Forssk. (1775).

*Vernacular names*: gharaiz(ah), kharaizah.

*Description*: Perennial subshrub. Stems 15–60 cm, glabrous, erect to spreading, branched, often reddish-green in colour, older stems woody at the base and leafless. Leaves alternate, 5–15 mm, succulent, subglobose to pyriform, perfoliate, green or reddish. Flowers in clusters forming dense terminal spikes, bisexual or female, connate to the bract; perianth segments 3; stamens 1–2. Pericarp membranous.

*Flowering and fruiting*: October to February.

*Distribution and habitat*: Throughout Oman, on saline and sandy coasts, and inland salt marshes (sabkhas), often present at the edges of sabkhas. *Altitude*: 0–100 m. Distributed from Palestine eastwards to S and SW Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

*Notes*: In Oman, a common halophytic low shrub, often present on highly saline soils and found at the edges of coastal sabkhas. The name of this species is based on material collected from Saudi Arabia by P. Forsskål (holotype C).

*Distribution map*: Fig. 49. *Illustration*: Plates 35, 36.

## 7. *Halocnemum* M. Bieb.

A single species distributed from C Mediterranean to C Asia.

*Halocnemum strobilaceum* (Pallas) M. Bieb., Fl. Taur.-Caucas. 3: 3 (1819).

*Synonyms*: *Salicornia strobilacea* Pallas (1771).

*Description*: Shrub, up to 60 cm. Stems intricate, erect to ascending, forming hummocks up to 1.5 m in diameter. Leaves  $\pm$  1 mm, obovate, scarious on the margins. Flowers bisexual, in clusters of 2–3 on short lateral and terminal branches, forming cone-like spikes; perianth segments 3, broadly oblong, united below, incurved at the tips, scarious; stamen 1. Fruit  $\pm$  1 mm in diameter, ovoid. Seeds compressed, brown.

*Flowering and fruiting*: More or less throughout the year.

*Distribution and habitat*: Northern Oman, on coastal dunes and sabkhas. *Altitude*: 0–20 m. Distributed in the Mediterranean region, eastwards to C Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 50.

*Notes*: Recorded by Boulos (op. cit., map 327) from Oman. The plant identified as *Halocnemum* in Barr al Hikman (distribution as shown on map 327) is actually *Arthrocnemum macrostachyum*.



8. *Arthrocnemum* Moq.

10 species, cosmopolitan in distribution.

*Arthrocnemum macrostachyum* (Moric.) K. Koch, Hort. Dendrol. 96, no. 3 (1853).

*Synonymy*: *Salsola macrostachya* Moric. (1820); *S. glauca* Del. (1813) non Stokes (1812); *Arthrocnemum glaucum* Ung.-Sternb. (1876).

*Vernacular names*: 'afkar; hojweb (Harsūsī), ṭeb (Jibbālī).

*Description*: Perennial succulent herb with a woody base, up to 1 m. Stems jointed, apparently leafless, ascending to decumbent, glaucous, branches sometimes rooting at the nodes on touching the ground and becoming prostrate; older stems woody, grey-green. Leaves reduced to small lobes, opposite and connate below. Flowers minute, hardly visible, in 3-flowered clusters (the central bisexual, laterals often unisexual male) present within connate bracts in inflorescences up to 6 cm; stamens 2, exserted and the yellow stamens visible when plant in flower. Fruiting perianth with pericarp membranous. Seeds  $\pm$  1 mm, black, glossy, papillose.

*Flowering and fruiting*: November to February.

*Distribution and habitat*: Throughout the coastal areas of Oman, including Halaniyah Island, on intertidal mud flats, and inland salt marsh areas (sabkhas). *Altitude*: Sea level. Distributed in S Portugal, S Africa, E Mediterranean to Iran and India. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 51. *Illustration*: Plates 37, 38.

9. *Suaeda* Forssk. ex Scop. (nom. conserv.)

*Schanginia* C. Meyer.

About 100 species, worldwide in distribution.

Key adapted from Boulos (1996).

- A. Large shrub, often with a thick trunk, and appearing as a small tree, up to 2 m. Plant monoecious .....2. *S. monioca*
- A\*. Shrubs, never tree-like, up to 1 m. Flowers bisexual or bisexual and female
  - B. Fruiting perianth with a conspicuous swollen and spongy base; lower part (ovary) fused to the perianth at maturity .....1. *S. aegyptiaca*
  - B\*. Fruiting perianth membranous, not spongy; lower part enveloped by, and not fused to the perianth at maturity
    - C. Flowers in compact leafless terminal panicles. Leaves flattened or semi-terete .....4. *S. moschata*
    - C\*. Flowers in leafy, axillary and terminal spikes or loose panicles. Leaves not flattened or flattened on one side only, some leaves terete .....3. *S. vermiculata*

1. *Suaeda aegyptiaca* (Hasselq.) Zohary, J. Linn. Soc. Bot. 55: 635 (1957).

*Synonymy*: *Chenopodium aegyptiacum* Hasselq. (1757); *Suaeda hortensis* Forssk. ex J.E. Gmelin (1791); *Suaeda baccata* Forssk. ex J.E. Gmelin (1791); *Schanginia hortensis* (Forssk. ex J.E. Gmelin) Moq. (1840); *Schanginia baccata* (Forssk. ex J.E. Gmelin) Moq. (1840); *Schanginia aegyptiaca* (Hasselq.) Aellen (1964).

*Vernacular names*: ḥarm, harm; qerzeb (Jibbālī), qerzot (Jibbālī).

*Description:* Annual or short-lived perennial. Stems 20–50 cm, erect to decumbent, glaucous-fleshy, green. Leaves alternate, sessile, 10–20 mm, terete to cylindrical or linear, fleshy and succulent, sometimes flattened above. Flowers bisexual and female, clustered in long, leafy spikes. Bracts deltoid with scarious margins. Perianth 5-lobed, c. 3 mm, green and fleshy, fruiting perianth with a conspicuous swollen base; stamens 5, female flowers with small staminodes; ovary adnate to the perianth. Seeds black, glossy.

*Flowering and fruiting:* August to February.

*Distribution and habitat:* Throughout Oman and on all offshore Islands, growing on coasts, on saline soils, often occurring above the high tide mark; weedy on saline soils on unused farmland. *Altitude:* 0–150 m. Distributed in N Africa and SW Asia, NE tropical Africa, Cyprus; naturalised in S Australia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 52. *Illustration:* Plate 39.

*Notes:* A variable, polymorphic species, differing in habit and the size of leaves.

2. *Suaeda monoica* Forssk. ex J.E. Gmel., Syst. Nat. ed. 1791, 2: 503 (1791).

*Vernacular names:* hamdeh (Jibbālī).

*Description:* Monoecious. Perennial shrub, 0.8–2 m, often with a thick trunk, and appearing as a small tree. Stems profusely branching, green, erect to decumbent, leafy, glabrous. Leaves alternate, sessile, 10–20(–30) mm, terete to linear, fleshy, flattened above and below. Flowers unisexual, clustered in long axillary, leafy spikes. Bracts deltoid, c. 1 mm, with scarious margins; male flowers bigger than the female flowers; perianth subglobose, c. 2 mm, perianth tube fused with the bracts; perianth deeply 5-lobed with scarious margins in male flowers, undivided in female flowers and enclosing the ovary; stamens 5. Seeds compressed, black, glossy.

*Flowering and fruiting:* November to June.

*Distribution and habitat:* Southern Oman and offshore islands of Halaniyah, Daymaniyah and Masirah, on beaches on sandy and saline soils. Common, and forming the dominant coastal vegetation on some of the Islands. *Altitude:* 0–100 m. Distributed in eastern Africa, Cape Verde Islands, Egypt to Palestine, SW Pakistan and Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 53. *Illustration:* Plate 40.

*Notes:* The name of this species is based on material collected from Yemen by P. Forsskal, No. 180 (lectotype C).

3. *Suaeda vermiculata* Forssk. ex J.E. Gmel., Syst. Nat. ed. 1791, 2: 503 (1791).

*Synonyms:* *Suaeda fruticosa* Forssk. ex J.E. Gmel. (1791); *Suaeda paulayana* Vich. (1903); *Suaeda volkensii* C.B. Clarke (1909).

*Vernacular names:* hamdeh, harm, sowād, sowaid.

*Description:* Perennial shrub, glabrous. Stems up to 1 m, branches erect to ascending, woody at the base, grey-white. Leaves alternate, shortly petiolate or sessile, up to 3 cm, cylindrical or oblong to lenticular, or flattened on one side, succulent, often grey-green, drying black. Flowers bisexual, in 2–5-flowered clusters, forming axillary or terminal spikes or loose panicles. Bracts deltoid-ovate; perianth segments c. 1 mm, adnate below, tips incurved, succulent; stamens 5; ovary not fused to the perianth except at the base. Seeds black, glossy.



*Flowering and fruiting:* November to June.

*Distribution and habitat:* Throughout Oman, including Halaniyah Island, in sandy, saline habitats, common on coasts, desert wadis and sabkhas. *Altitude:* 0–1200 m. Distributed from Cape Verde and Canary Islands to W. Africa through N. Africa, SW Asia eastwards to India, and southwards to Eritrea, Socotra and Abchei Kuni Islands. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen. Also found in Socotra.

*Distribution map:* Fig. 54. *Illustration:* Plate 41.

4. *Suaeda moschata* A.J. Scott, Kew Bull. 36(3): 558 (1981).

*Type:* Oman, Dhofar, 45 km N of Salalah, 6 Oct. 1977, *Rudolphi-Smith* 3538 (holotype K).

*Vernacular names:* sowād, sowaid.

*Description:* Lax perennial shrub. Stems erect to ascending to decumbent, up to 50 cm, densely leafy, woody at the base. Leaves sessile, 5–15 × 3–8 mm, spirally arranged, broadly ovate to suborbicular, succulent, flattened or semi-globose, decreasing in size upwards. Flowers sessile, bisexual, solitary or in 2–3-flowered clusters forming terminal and lateral racemes, up to 10 cm. Bracts ± 1 mm, scarious, perianth segments 1–2 mm, fused below, yellow-green, margins scarious; stamens 2–3. Seeds rounded.

*Flowering and fruiting:* November to January. But also flowering sporadically.

*Distribution and habitat:* Northern, Central and Southern Oman and the offshore islands of Halaniyah, Diarmaniya and Masrah, occurring along the coastline, on sandy beaches and coastal dunes, on sand and shell debris. *Altitude:* 0–25 m. Endemic to Oman.

*Distribution map:* Fig. 55. *Illustration:* Plates 42, 43.

*Note:* Localised in its distribution but not uncommon. It forms an important component of the unique succulent coastal shrub community found on the Barr al Hikman peninsula in central Oman.

# 10. *Cornulaca* Del.

7 species, distributed from Egypt to C Asia.

A. Leaves acicular to linear-subulate, straight or recurved. Bracteoles about as long as the bracts . . . . .1. *C. aucheri*

A\*. Leaves subulate to triangular, spine-tipped. Bracteoles shorter than the bracts . . . . .2. *C. monacantha*

1. *Cornulaca aucheri* Moq., Chenopodium Monogr. Enum. 163 (1840).

*Synonymy:* *Cornulaca leucacantha* Charif & Aellen (1950).

*Vernacular names:* hesli.

*Description:* Annual or perennial herb, up to 10 cm. Stems erect, branching from the base, stiff and rigid. Leaves alternate, 8–10 × 1 mm, acicular to linear-subulate, straight or recurved, base clasping, spinescent; long white hairs present in leaf axils. Flowers bisexual, small, 1–8 in glomerules surrounded with tufts of white hairs, subtended by a bract and 2 bracteoles; bract 6–8 mm, spinescent; bracteoles about as long as the bract; perianth segments 5, 2 mm, indurated and fused in fruit; stamens 5, filaments fused. Seeds rounded-compressed, yellow.

*Flowering and fruiting:* February to March.

*Distribution and habitat:* Northern and central Oman, in sandy and silty areas, wadi fans and coastal plains. *Altitude:* 0–300 m. Distributed in Iraq, Iran, and from Baluchistan to Afghanistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 56. *Illustration:* Plate 44.

*Notes:* An indicator species of the Nubo-Sindian phytochorion. Grazed by goats and camels.

2. *Cornulaca monacantha* Del., Fl. Aegypt. Ill. 206, t. 22, f. 3 (1814).

*Synonyms:* *Cornulaca arabica* Botsch. (1969).

*Vernacular names:* hath, hadh, silih (Harsūsi).

*Description:* Perennial shrub, up to 50 cm. Stems erect to spreading, branching from the base, woody below. Leaves alternate, 3–10 mm, subulate to triangular, spine-tipped. Flowers bisexual, small, 1–8 in glomerules, surrounded by tufts of white hairs, glomerules subtended by a bract and 2 bracteoles; bract  $\pm$  8 mm, spinescent; bracteoles shorter than the bract; perianth segments 5, 2–3 mm, indurate and fused in fruit; stamens 5, filaments fused at the base. Seeds rounded-compressed, yellow.

*Flowering and fruiting:* October to May.

*Distribution and habitat:* Throughout Oman, on stabilised dunes, gravelly and sandy coastal wadis, and gravel wadi plains. *Altitude:* 0–650 m. Distributed in western tropical and N Africa, SW Asia eastwards to Pakistan. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 57. *Illustration:* Plate 45.

*Notes:* Boullos in Miller & Cope (1996) records that the species is variable in the presence of spines and that some plants may be without spines. In Oman material some plants have longer spines than the others, a feature common in plants that are grazed. Grazed by camels and goats.

11. *Haloxylon* Bunge

*Hammada* Iljin

10 species, distributed from W Mediterranean to Iran, Mongolia, Burma and SW China.

*Haloxylon salicornicum* (Moq.) Bunge ex Boiss., Fl. Or. 4: 949 (1879).

*Synonyms:* *Hammada salicornica* (Moq.) Iljin (1948); *Caroxylon salicornicum* Moq. (1849);

*Haminada elegans* (Bunge) Botsch (1964).

*Vernacular names:* remth, rimth.

*Description:* Shrub, up to 1 m. Stems and branches spreading, jointed, fleshy when young, becoming woody when older. Leaves reduced, sometimes enlarged and red (with gall-producing insects), opposite, triangular, fused below; margins membranous, woolly in the axils. Flowers bisexual or male, in dense axillary spikes; bracteoles 2, ovate; perianth segments 5, membranous; stamens 5, filament fused below. Fruiting perianth with conspicuous pink or yellow-brown membranous wings, wings 6–8 mm, unequal, ovate to orbicular, overlapping.

*Flowering and fruiting:* October to February.

*Distribution and habitat:* Throughout Oman, in wadis and gravelly plains. Common. *Altitude:* 0–1000 m. Distributed in Egypt and SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.



*Distribution map:* Fig. 58. *Illustration:* Plates 46, 47.

## 12. *Salsola* L.

About 150 species, cosmopolitan in distribution.

Key adapted from Boulos (1996).

- A. Leaves entirely glabrous, terete, clavate or obpyriform
  - B. Leaves clavate, obpyriform or subglobular, 2–5(–8) mm . . . . . 1. *S. drummondii*
  - B\*. Leaves linear, 5–25 mm, often curved . . . . . 2. *S. schweinfurthii*
- A\*. Leaves hairy, not terete, clavate or obpyriform
  - C. Leaves in two opposite ranks, overlapping
    - D. Leaves 4–9 × 1–2 mm, silvery pubescent, but glabrescent with age . . . . . 3. *S. rubescens*
    - D\*. Leaves 1.5 × 1.5 mm, densely covered with adpressed scurfy scale-like hairs . . . . . 4. *S. omanensis*
  - C\*. Leaves neither in two opposite ranks nor overlapping
    - E. Hairs on young shoots and leaves medifixed (stalked, branched into two) . . . . . 6. *S. spinescens*
    - E\*. Hairs on young shoots and leaves simple
      - F. Stems not unpleasantly smelling of rotting fish. Leaves triangular, densely adpressed tomentose with silvery hairs . . . . . 5. *S. cyclophylla*
      - F\*. Stems unpleasantly smelling of rotting fish. Leaves on younger plants and young plant parts linear, mature leaves ovate-orbicular, sparsely hairy . . . . . 7. *S. imbricata*

1. *Salsola drummondii* Ulbr. in Engl. & Prantl., Nat. Pflanzentam. 2 Aufl. 16C: 256 (1934).  
*Synonyms:* *Salsola obpyrifolia* Botsch & Akhani (1989).

*Description:* Shrub, 30–70 cm. Stems glabrous, grey-white, the older branches becoming gnarled. Leaves subopposite or alternate, sessile, 2–5(–8) × 2–3 mm, clavate to subglobose or obpyriform, succulent, obtuse at the top. Flowers bisexual, subtended by 2 bracts, in terminal leafy panicles. Bracts succulent, perianth segments 5, scarious, developing a wing in fruit, 5–7 mm (including the wings), wings subequal, yellow-tinged red; stamens 5. Fruit subglobose.

*Flowering and fruiting:* ?March, April.

*Distribution and habitat:* Central Oman, in saline and sandy coastal areas. *Altitude:* 0–150 m. Distributed in S Iran, Pakistan and India. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 59.

## 2. *Salsola schweinfurthii* Solms-Laub., Bot. Zeit. 59: 173 (1901).

*Description:* Shrub, 20–50 cm; stems ascending, glabrous, younger branches white, the older branches becoming brown. Leaves subopposite or alternate, sessile, 5–25 × 2–3 mm, linear-terete, straight or curved, with an apiculate tip, and tufts of hairs in the leaf axils. Flowers bisexual, subtended by 2 bracts, 2–5 in the upper axils of leaves, forming spikes; bracts succulent, broadly ovate, perianth segments 5, with white, scarious margins, developing a wing in fruit, perianth 4–7 mm (including the wings), wings subequal; stamens 5.

*Flowering and fruiting:* ?March.

*Distribution and habitat:* Rocky coastal areas, amongst calcareous rocks and saline sand. *Altitude:* 0–350 m. Distributed in Egypt, Palestine and Jordan. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 60.

**3. *Salsola rubescens*** Franchet, Sert. Somal.: 60 (1882).

*Synonyms:* *Salsola hadramautica* Baker (1894); *Salsola leucophylla* Baker (1894).

*Vernacular names:* khumkhām (also in Harsūsī).

*Description:* Shrub, 20–50 cm. Stems branching from the base, erect to spreading, canescent with silvery adpressed hairs. Leaves arranged in 2 opposite overlapping rows, sessile, 4–9 × 1–2 mm, cylindrical to triangular, base decurrent, fleshy, silvery-green pubescent, glabrescent with age. Flowers bisexual, solitary, in the axil of leaves, in spicate inflorescences; perianth segments 5, ± 3 mm, unequal, membranous with pilose apices, red to yellow-red; stamens 5. Fruiting perianth 4–5 mm (including the wings), densely pilose at the apex.

*Flowering and fruiting:* November to January.

*Distribution and habitat:* Throughout Oman, in the central desert and coastal areas, in open, gravel, saline and sandy places. Often common by road sides. *Altitude:* 0–250 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in UAE, Yemen (S).

*Distribution map:* Fig. 61. *Illustration:* Plates 48, 49.

*Notes:* Distinct in fruit with the red to yellow-red membranous wings. Grazed by camels.

**4. *Salsola omanensis*** Boulos, Kew Bull. 46: 297, t. 1 (1991).

*Type:* Oman, Dhofar, cliffs above Schuaimiyah, 27.ix.1984, Miller 6409 (holotype F; isotypes K, ON).

*Description:* Shrub, up to 50 cm, with divaricate branches. Young branches densely covered with leaves, grey-green. Leaves linear, ± 1.5 cm, adnate to the stem, rigid, covered with scurfy, scale-like hairs. Flowers bisexual, few at the tips of branches; bracts 2, similar to the leaves; perianth segments 5, ± 3 mm, free, concave, with scarious margins; stamens 5. Fruiting perianth connivent, 5.5–6 mm, with scarlet membranous wings.

*Flowering and fruiting:* October.

*Distribution and habitat:* Central Oman, occurring on the central limestone plateau. Also distributed in southern Oman (Dhofar) and the Halaniyah Islands. Endemic. *Altitude:* 50–300 m.

*Distribution map:* Fig. 62. *Illustration:* Plate 50.

*Notes:* Endemic to Oman. Fairly common on the Halaniyah Islands around the Kuria Muria bay and the Sahil al Jazir coast of central Oman. The species is similar to *S. ptenophylla* from Somalia, but differs in its indumentum and its leaf and perianth characters.

**5. *Salsola cyclophylla*** Baker, Bull. Misc. Inform. 1894: 340 (1894).

*Description:* Shrub, 20–60 cm. Stems erect to ascending, branches whitish grey, woody, the older lateral branches spinescent. Leaves crowded into clusters, ± 2 mm, sessile, triangular, densely adpressed tomentose with silvery hairs. Flowers bisexual, crowded in lateral spikes, bracts ± 1.5 mm; perianth segments 5, ± 2 mm, densely hairy above and below the wings.



stamens 5; fruiting perianth  $\pm 4$  mm (including the wings); perianth segments densely pubescent.

*Flowering and fruiting*: February to April; September, October.

*Distribution and habitat*: Northern and C Oman: in pockets of sand on rocky limestone outcrops. *Altitude*: 50–350 m. Distributed from Egypt to Iraq, Sudan, Ethiopia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen (S).

*Distribution map*: Fig. 63.

*Notes*: The name of this species is based on material collected from Yemen (S) by W. Lunt 53 (holotype BM).

6. *Salsola spinescens* Moq. in DC., Prodr. 13(2): 179 (1849).

*Description*: Spiny shrub, up to 50 cm. Stems with divaricate branching, spine-tipped. Leaves  $\pm 2$  mm, ovate, somewhat fleshy, with scarious margins, young leaves covered with medifixed hairs. Flowers bisexual, solitary; bracts leaf-like; perianth segments 5, 1.5–2.5 mm; fruiting perianth  $\pm 4$  mm (including the wings), wings white-pink.

*Flowering and fruiting*: September to November.

*Distribution and habitat*: Northern and Southern Oman: on the coastal plains, in sandy and saline soil and on rocky ground. *Altitude*: 0–450 m. Distributed in NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 64.

*Notes*: Rare or uncommon, or perhaps under collected in Oman. Collected only once from the Marbat coast, Dhofar. The name of this species is based on material collected from Saudi Arabia by Botta (holotype P).

7. *Salsola imbricata* Forssk., Fl. Aegypt.-Arab. 57 (1775).

*Synonymy*: *Chenopodium baryosma* Schult. ex Roem. & Schult. (1820); *Crocydon imbricatum* (Forssk.) Moq. (1849); *Salsola baryosma* (Roem. & Schult.) Dandy (1950).

*Vernacular names*: 'arōt (Harsūsī), 'arād (Harsūsī), khadirāf (Jibbālī).

*Description*: Shrub up to 70 cm. Stems spreading, forming clumps up to 2 m across, unpleasantly smelling of fruiting lvs. Leaves alternate, congested, imbricate, leaves on younger plants linear; mature leaves  $\pm 2$  mm, ovate-orbicular, older ones fleshy, sparsely hairy. Flowers bisexual, solitary, in dense clusters; bracts imbricate; perianth segments 5,  $\pm 1.5$  mm, connivent; fruiting perianth 4–6 mm (including wings), wings membranous.

*Flowering and fruiting*: October to February (to June).

*Distribution and habitat*: Throughout Oman: on coastal areas. *Altitude*: 0–450 m. Distributed in N and E Africa, Arabia eastwards to India and northwards to Syria. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 65. *Illustration*: Plate 51.

*Notes*: A variable species, never grazed by goats or camels. Common in Oman, especially on rocky coasts. The name type is based on material collected from Yemen (N) chosen by J.R.I. Wood 1184 (K, E).

### 13. *Halothamnus* Jaub. & Spach

About 23 species, distributed in SW and C Asia and NE Africa.

*Halothamnus bottae* Jaub. & Spach, Ill. Pl. Orient. 2: 50, t. 136 (1845).

*Synonyms*: *Caroxylon bottae* (Jaub. & Spach) Moq. (1849); *Salsola bottae* (Jaub. & Spach) Boiss. (1879).

*Description*: Shrub, 20–60 cm. Stems ascending, branched, rigid and spinescent, blue-green, older stems yellow-brown. Leaves fleshy, triquetrous,  $\pm$  1.5 mm, somewhat clasping the stem, with axillary tufts of hairs. Bracts c. 2 mm, triangular; bracteoles ovate, mucronate. Flowers in panicles, in the axils of the upper branches; perianth segments 5, 2–3 mm, triangular-ovate, with scarious margins; stamens 5. Fruiting perianth winged, 4–8 mm in diameter with wings, wings membranous, attached below the middle of fruit.

*Flowering and fruiting*: November to March.

*Distribution and habitat*: More or less throughout Oman, in the foothills and wadi fans, in dry, saline, sandy and stony places, waste and disturbed places. *Altitude*: 20–250 m. Endemic to the Arabian Peninsula where it is found in Saudi Arabia, Yemen (N and S), UAE.

*Distribution map*: Fig. 66. *Illustration*: Plate 52.

### 14. *Sevada* Moq.

A single species found in tropical E Africa, NE Africa, Arabia.

*Sevada schimperi* Moq. in DC., Prodr. 13 (2): 154 (1849).

*Synonyms*: *Suaeda schimperi* (Moq.) Martelli (1888); *Suaeda vermiculata* Forssk. ex J.E. Gmel. var. *puberula* C.B. Clarke (1909).

*Description*: Glabrous shrub. Stems up to 40 cm, branched; branches ascending to erect, spreading, woody at the base. Leaves subopposite, 2–15  $\times$  1–2 mm, cylindrical, indurate, glaucous, with a tuft of hairs in the leaf-axil. Flowers in clusters of 3–10, forming terminal spikes; perianth segments  $\pm$  1 mm, subglobose, fruiting perianth with a ribbed tube. Fruit with an acute tip.

*Flowering and fruiting*: September, November.

*Distribution and habitat*: Southern Oman, Dhofar, including Halaniyah Island on sandy coastal plains and cliffs. *Altitude*: 0–100 m. Distributed in east tropical Africa, Egypt. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 67.

*Notes*: The name of this species is based on material collected from Saudi Arabia by Schimper 867 (BM, E, G, LE).

### 15. *Anabasis*

30 species, distributed in C Asia and the Mediterranean region.

*Anabasis setifera* Moq., Chenop. Monogr. Enum. 164 (1840).

*Synonyms*: *Seidlitzia lanigera* Post (1896).

*Vernacular names*: naqāwa.



*Description:* Fleshy annual herb, often with a woody rootstock, up to 60 cm. Branches thick, green, divaricate. Leaves opposite, fleshy, terete,  $\pm 3.5$  mm, base clasping. Flowers small, white, in axillary clusters; petals absent. Fruit 5-winged, each wing  $\pm 3$  mm across; wings white-membranous, orbicular.

*Flowering and fruiting:* October to February.

*Distribution and habitat:* Throughout Oman, in sandy and gravelly locations, in the foothills and wadis. *Altitude:* 50–100 m. Distributed in SW Asia, Egypt. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 68. *Illustration:* Plate 53.

*Note:* The name of this species is based on material collected from Persia, between Tehran and Isfahan by Oliver (holotype G).

## 16. Amaranthaceae

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### Key to the genera of Amaranthaceae in Oman

- A. Leaves alternate
- B. Fertile flower subtended by 2 modified sterile flowers ..... 3. **Digera**
- B\*. All flowers fertile
- C. Perianth glabrous
- D. Flowers always bisexual. Perianth pink, usually with 2 or more veins. .... 1. **Celosia**
- D\*. Flowers unisexual. Perianth green with a single central vein. .... 2. **Amaranthus**
- C\*. Perianth lanate ..... 5. **Aerva**
- A\*. Leaves opposite or subopposite
- E. Fertile flowers subtended by 2 sterile flowers which are modified into hooked spines ..... 4. **Pupalia**
- E\*. Flowers not as above
- F. Fruits deflexed at maturity ..... 7. **Achyranthes**
- F\*. Fruits not deflexed at maturity
- G. Stems more or less ascending to prostrate. Flowers in axillary globose clusters. .... 8. **Alternanthera**
- G\*. Stems erect. Flowers in open panicles. .... 6. **Psilotrichum**

1. **Celosia** L.

50 species, distributed in the warm regions of both the Old and New Worlds.

- A. Leaves 15–30×7–18 mm, ovate to ovate-lanceolate .....1. **C. trigyna**
- A\*. Leaves 2–15×1–3 cm, lanceolate to lanceolate-oblong .....2. **C. argentea**

1. **Celosia trigyna** L., Mant. Pl. Alt. 2: 212 (1771).  
*Synonyms:* *Celosia trigyna* L. var. *fasciculiflora* Moq. (1849).

*Description:* Annual herb, up to 20 cm. Stems erect, scarcely branched, glabrous to sparsely pubescent. Leaves alternate, petiolate, 15–30 × 7–18 mm, ovate to ovate-lanceolate, glabrous to sparsely pubescent; petiole up to 10 mm; leaves falling at the time of fruiting. Flowers white to pale pink, in terminal and axillary cylindrical spikes; bracts scarious; perianth 1.5–3 mm, scarious, 2 or more veined. Capsule ± 2mm.

*Flowering and fruiting:* September, October.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment mountains in woodland, in shaded locations, often by water. *Altitude:* 200–1500 m. Distributed in tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 69.

*Notes:* Common in Dhofar, coming up after the monsoons. Often weedy.

2. **Celosia argentea** L., Sp. Pl. 205 (1753).

*Description:* Annual herb, up to 1 m. Stems erect to ascending, sulcate and ridged. Leaves alternate, 2–15×1–3 cm, lanceolate to lanceolate-oblong, base tapering into a short petiole. Flowers in terminal spikes, silvery-pink; perianth 6–10 mm, elliptic with 2–4 lateral nerves, and with wide hyaline margins; stamens 5, filaments fused below to form a staminal sheath. Capsule 3–4 mm, subglobose.

*Flowering and fruiting:* April, May.

*Distribution and habitat:* Throughout Oman, in wasteland, disturbed areas and in cultivated and irrigated places. *Altitude:* 0–500 m. A pantropical weed of cultivation. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 70.

2. **Amaranthus** L.

About 60 species, distributed in the tropical and warm temperate regions of both the Old and New Worlds.

- A. Capsule woody, arranged in a stellate cluster in the axils of leaves .....4. **A. sparganiocephalus**
- A\*. Capsule thin-walled, not woody, not arranged as above
- B. Flowers in axillary clusters only .....3. **A. graecizans**
- B\*. Flowers in terminal and axillary clusters
- C. Capsule smooth .....1. **A. hybridus**
- C\*. Capsule wrinkled
- D. Inflorescence with the lower spikes entirely female, the upper spikes with female flowers below and male flowers at the top. ....2. **A. dubius**



10\*. Inflorescence with male and female flowers intermixed in axillary and terminal spikes . . . . .5. **A. viridus**

1. *Amaranthus hybridus* L., Sp. Pl. 990 (1753).

*Description:* Annual herb, up to 60 cm. Stems branching from the base, erect to ascending, angular. Leaves alternate, 3–20 × 1.5–8 cm, broadly lanceolate to rhomboid to ovate, glabrous to thinly pilose. Flowers unisexual, male and female flowers intermixed, in cymose clusters arranged in spikes, spikes branched at the top, usually unbranched below, bracts and bracteoles ovate, aristate, female perianth 5, 1–3 mm, oblong, aristate, smaller than the bracteoles. Capsule 2–3 mm, subglobose, smooth, dehiscent.

*Flowering and fruiting:* After rain, generally from January to April, but more or less throughout the year in irrigated places.

*Distribution and habitat:* Throughout Oman, in irrigated, waste and disturbed places, weedy in gardens. *Altitude:* 20–1800 m. A cosmopolitan weed of warm and temperate places. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 71.

*Notes:* *A. hybridus* subsp. *cruentus* (L.) Thell. is recognised on the size of the bracteoles of female flowers being the same size as the perianth, whereas in *A. hybridus* subsp. *hybridus* the bracteoles of female flowers are longer than the perianth. *A. hybridus* subsp. *cruentus* is recorded from Yemen and Saudi Arabia. The leaves of *A. hybridus* are edible and used as spinach in soups and curries.

2. *Amaranthus dubius* Thell., Fl. Adv. Montpellier: 203 (1912).

*Description:* Annual herb, up to 50 cm. Stems erect to ascending. Leaves alternate, 1.5–5 × 0.5–3 cm, ovate to rhomboid-ovate, apex obtuse or retuse, base tapering into a short or long petiole. Flowers unisexual, the lower spikes entirely female, the upper spikes with female flowers below and the male flowers at the top, rarely intermixed; bracts ovate, membranous, aristate; perianth 5, 1–2 mm, narrow-oblong, with a white membranous margin, midrib green and produced into a short mucro. Capsule ± 1.5 mm, subglobose, with an inflated beak, wrinkled, dehiscent.

*Flowering and fruiting:* February to May.

*Distribution and habitat:* Northern Oman, Musandam, in irrigated date gardens. Weedy. *Altitude:* 300–350 m. Distributed in the tropical regions of the world. In the Arabian Peninsula recorded only from Oman.

*Distribution map:* Fig. 72.

*Notes:* Recorded only from Musandam, but possibly also occurring in the western Hajar.

3. *Amaranthus graecizans* L., Sp. Pl. 990 (1753).

*Vernacular names:* dad, qutqai(ah), shepra al sanren, sindar, remteliq (Jibbali), remteli (Zutari Arabic).

*Description:* Annual herb, up to 45 cm. Stems branching from the base, erect to ascending, angular. Leaves alternate, 4–50 × 2–30 mm, broadly ovate to rhomboid-ovate or lanceolate, apex obtuse or acute or retuse. Flowers unisexual, intermixed in axillary cymose clusters; bracts

narrow-ovate, membranous, aristate; perianth 3, 1–2 mm, oblong-ovate, with a green midrib ending in an apical mucro. Capsule 1–2 mm, subglobose, strongly wrinkled, dehiscent or not.

*Flowering and fruiting*: More or less throughout the year.

*Distribution and habitat*: Throughout Oman, and including the offshore islands of Hallaniyah and Masirah, on disturbed and irrigated places, irrigated tree pits, waste and disturbed ground. Common and weedy. *Altitude*: 0–2000 m. Distributed in the warm temperate and tropical regions of the Old World. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 73.

*Notes*: Several subspecies are recognised based on the length of leaves and shape of the perianth segments. Miller & Cope (1996) recognise three subspecies: *A. gracizans* subsp. *thellin-gianus* (Nevski) Gusev (1972), in which the perianth segments are aristate, and the leaves linear to rhombic-spatulate, *A. gracizans* subsp. *gracizans*, in which the perianth segments are mucronate and the leaves linear-lanceolate to oblong, and *A. gracizans* subsp. *silvestris* (Villars) Heukels (1934), in which the perianth segments are mucronate and the leaves elliptic to broadly ovate. The Oman material that I have examined has several intermediary forms, especially of leaf shape, and I have found it difficult to assign the three subspecies. I have therefore, not attempted to distinguish infraspecific categories in this flora.

4. *Amaranthus sparganioccephalus* Thell. in Asch. & P. Graebner, Syn. Mitteleur. Fl. 5: 1: 312 (1914).

*Description*: Annual herb, up to 30 cm. Stems erect, woody. Leaves alternate, petiolate, 15–30×7–18 mm, ovate to elliptic, apex obtuse; petioles 25–30 mm. Flowers unisexual, in axillary clusters, male and female flowers intermixed; bracts and bracteoles ovate to oblong-ovate; female flowers: perianth 3,  $\pm$  1 mm, oblong-obovate, with a pointed tip. Capsule  $\pm$  4 mm, woody, ovoid, ridged longitudinally, dehiscent, arranged in a stellate cluster in the axils of leaves.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, in wadis on the foothills of the escarpment mountains, in moist locations, in irrigated fields, and by water. *Altitude*: 0–150 m. Distributed in E and NE tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen. Also found in Soqatra.

*Distribution map*: Fig. 74.

*Notes*: The species is not common in Oman, but is possibly under-collected as it occurs in areas that are over-grazed by camels and cattle.

5. *Amaranthus viridis* L., Sp. Pl. 1405 (1763).

*Synonyms*: *Chenopodium caudatum* Jacq. (1788); *Amaranthus gracilis* Desf. (1804).

*Description*: Annual herb, up to 50 cm. Stem erect to ascending, reddish-green, striate. Leaves alternate, 2–7×2–5 cm, ovate to rhomboid-ovate, apex acute, obtuse or retuse, base tapering into a short or long petiole. Flowers unisexual, intermixed in axillary and terminal spikes narrowing at the top; bracts membranous; perianth 3(–4), 1–2 mm, narrow-oblong, with a white membranous margin and a green midrib, produced into a short mucro. Capsule  $\pm$  1 mm, subglobose, wrinkled, rupturing irregularly at maturity.



*Flowering and fruiting*: Throughout the year.

*Distribution and habitat*: Throughout Oman, in cultivated and irrigated areas. A common weed on cleared and disturbed areas on the escarpment hills in Dhofar, and in date groves in northern Oman. *Altitude*: 0–1500 m. Pan-tropical. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 75.

*Note*: This is one of the most widely occurring and common species of the genus in Oman.

### 3. *Digera* Forssk.

Monotypic, distributed in the Old World tropics.

*Digera muricata* (L.) Mart., Nova Act. Acad. Caes. Leop.-Carol., Nat. Curios. 13(1): 285 (1826).

*Synonyms*: *Achyranthes muricata* L. (1762); *Digera arvensis* Forssk. (1775).

*Description*: Annual herb, 20–50 cm. Stems simple, erect to ascending, ridged. Leaves alternate, 20–60 × 6–30 mm, linear to ovate, base abruptly narrowing into the petiole. Flowers bisexual, white or pink, in axillary racemes; bracts membranous, each subtending 3 flowers, the central flower fertile, and the lateral 2 sterile; perianth of 5 unequal segments, 3–4 mm, the outer 2 longer and many-nerved, the inner shorter and 1–3-nerved; stamens 5. Capsule subglobose, ridged and covered with a persistent style, indehiscent and falling entire with the perianth, sterile flowers and bracts.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Throughout Oman, but more common in Dhofar, as a weed of cultivated and irrigated places, often growing by water pools, and on moist disturbed places. *Altitude*: 20–1200 m. Widespread in Asia, S, C and E tropical Africa and Madagascar. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 76.

### 4. *Pupalia* A. Juss. (nom. conserv.)

*Pupal* Adanson

4 species, distributed in the tropics of the Old World.

*Pupalia lappacea* (L.) A. Juss., Ann. Mus. Par. ii, 132 (1803)

var. *velutina* (Moq.), Hook. f., Fl. Brit. Ind., 4: 724 (1885).

*Synonyms*: *Achyranthes lappacea* L. (1753); *Pupalia velutina* Moq. (1849).

*Vernacular names*: hab al 'ajaiz; mesogh (Jibbālī).

*Description*: Annual or perennial herb, up to 30 cm. Stems branched, erect to straggling, 4-angled or terete, swollen at the nodes. Leaves opposite, 2–12 × 1–6 cm, ovate to ovate-elliptic to lanceolate, subglabrous to sericeous. Flowers in clusters of 3 bisexual flowers and modified sterile flowers, all arranged in terminal spikes. Bracts persistent, deflexed after fruit fall; the outer 2 bisexual flowers bracteolate, and subtended by modified flowers consisting of a number of sharply hooked spines up to 6 mm long, spines pale-yellow; bracteoles of bisexual flowers broadly-ovate, mucronate with an excurrent midrib; perianth 4–5, 3-nerved, lanate; flower clusters 8–15 mm, falling entire. Capsule 2–3 mm, ovoid, dehiscence irregular. Seed single.

*Flowering and fruiting*: March to May; September, October.

*Distribution and habitat:* Throughout Oman, in disturbed places, clearings, wadis banks and wadi beds, and by track roads. *Altitude:* 0–1800 m. Throughout the Old World tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 77.

*Notes:* All Arabian material is referable to var. *velutina* Moq. Hook. characterised by the lanate perianth and pale yellow spines (Miller & Cope 1996).

5. **Aerva** Forssk. (nom. conserv.)  
*Ouret* Adams.

10 species, distributed in the warm tropical regions of the Old World.

- A. Flowers in lateral globose clusters arranged in long spikes. Leaves 10–50 mm long, obovate to spatulate ..... 1. **A. javanica**
- A\*. Flowers in few-flowered clusters arranged in long interrupted spikes. Leaves 4–25 mm long, elliptic to ovate ..... 2. **A. artemisioides**

1. **Aerva javanica** (Burm. f.) J.A. Schultes, Syst. Veg. ed. 15, 5: 565 (1819).  
*Synonyms:* *Iresine javanica* Burm. f. (1768); *Aerva tomentosa* Forssk. (1775); *Achyranthes javanica* (Burm. f.) Pers. (1805).  
*Vernacular names:* ra, rā (also in Jibbālī); eṭhe, eṭṭe, ṭhiw (Jibbālī); fehawen (Harsusi).

*Description:* Dioecious subshrub, up to 60 cm, often forming open clumps, densely tomentose. Stems erect, woody at the base. Leaves alternate, 10–50 × 8–15 mm, obovate to spatulate, grey-green, densely white-woolly. Flowers unisexual, in lateral globose clusters, arranged in long spikes and forming open leafless panicles (clusters interrupted in *A. javanica* var. *bovei* Webb). Bracts lanate, persistent; perianth 5, 2–3 mm, the outer segments slightly longer than the inner, lanate with a green midrib; stamens 5; male flowers smaller than the female flowers, with pseudostaminodes and a rudimentary ovary. Capsule ± 1 mm, compressed globose. Seed single.

*Flowering and fruiting:* More or less throughout the year.

*Distribution and habitat:* Throughout Oman, including the offshore islands, common in open disturbed and waste places, irrigated fields and plantations. *Altitude:* 0–2000 m. Distributed in the drier parts of the tropics of the Old World. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 78. *Illustration:* Plate 54.

*Notes:* Species variable in the shape and size of leaves and compactness of flower clusters. *A. javanica* var. *bovei* Webb. is recognized by some authorities on its interrupted flower clusters.

2. **Aerva artemisioides** Vierh. & O. Schwartz  
subsp. **batharitica** A.G. Miller, Edinb. J. Bot. 51 (1): 35 (1994).

*Type:* Oman, Dhofar, A.G. Miller 6421 (holotype E, isotypes K, KUTH, ON, UPS)

*Description:* Subshrub to 1 m, forming open clumps, densely tomentose. Stems erect. Leaves alternate, 4–25 × 5–12 mm, elliptic to ovate, densely tomentose. Flowers minute, bisexual, in few-flowered clusters arranged in long interrupted spikes and forming open, leafless panicles. Perianth 6, oblong-elliptic to broadly ovate, 1–1.5 mm, densely tomentose dorsally; 2 outer rounded, the membranous margin broad; 4 inner acute, the membranous margin narrow; stamens 4; pseudostaminodes triangular or oblong. Stigma sessile, capitate.



*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, restricted to eastern Dhofar, occurring from Sudh to Ras Mudhraka on the Sahul al Jazr coast and the dissected limestone plateau above, on dry cliffs, and rocky slopes, and on the coastal limestone cliffs. *Altitude*: 20–300 m. Endemic to Oman.

*Distribution map*: Fig. 79.

*Notes*: Very localised in its distribution, and under some threat on coasts from indiscriminate driving of 4-wheel trucks by fishermen. The type subsp. *Artemisoides* subsp. *artemisoides* differs from the *A. artemisoides* subsp. *butleriana* in its linear-oblong to linear-oblanccolate leaves (10–40 × 2–5 mm), and in its distribution which is restricted to the Hadhramaut and Mahra in southeastern Yemen.

## 6. *Psilotrichum* Blume

18 species, distributed in tropical Asia and Africa.

*Psilotrichum virgatum* C.C. Townsend, Kew Bull. 35: 377 (1980).

*Description*: Perennial herb, up to 1 m. Stems weak, erect to ascending, virgate, striate, glabrous. Leaves opposite, reducing in size upwards, linear, 10–60 × 1–2 mm, glabrous. Flowers bisexual, sessile, in large open panicles or branched spikes; perianth 5, green, 1–3 mm, the outer 2 segments oblong, with 3 distinct nerves, the inner segments with less defined lateral nerves and membranous margins. Capsule ovoid.

*Flowering and fruiting*: September, October.

*Distribution and habitat*: Southern Oman, Dhofar, on the south-facing wadis of the escarpment mountains, in the *Acacia Commiphora* shrubland. *Altitude*: 150–250 m. Distributed in Somalia, NE Africa, India. Elsewhere in the Arabian Peninsula found in Yemen (S). Also found in Socotra.

*Distribution map*: Fig. 80. *Illustration*: Plates 55, 55a.

*Notes*: Not common in Dhofar, but possibly grazed back and under-collected.

## 7. *Achyranthes* L.

6 to 8 species, distributed in the warm temperate and tropical regions of the Old World.

*Achyranthes aspera* L., Sp. Pl. 204 (1753).

*Synonyms*: *Achyranthes aspera* var. *indica* L. (1753); *A. indica* L. (1768).

*Vernacular names*: 'harsha'.

*Description*: Perennial herb, up to 60 cm. Stems erect to decumbent, often woody at the base, 4-angled or ridged, glabrous to tomentose. Leaves opposite, 1.5–6 × 1–5 cm, variable in shape from ovate to elliptic to ovate-lanceolate, glabrous to densely tomentose. Flowers in spicate inflorescence, congested when young, becoming lax with age. Flowers often deflexed. Bracts spinous, persistent. Perianth segments 5, 3–7 mm, lanceolate with a distinct midrib and 2 lateral nerves. Capsule 1–3 mm. Entire flower with bracts falling together.

*Flowering and fruiting*: January to May; September to November.

*Distribution and habitat*: Throughout Oman, in cultivated and disturbed areas, rocky slopes, wadi beds. A common weed of disturbed land. *Altitude*: 0–2000 m. Distributed in tropical and

warm temperate regions of the world. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 81. *Illustration:* Plates 56, 56a.

*Notes:* A variable species. Two varieties (*A. aspera* var. *sicula* L. and *A. aspera* var. *pubescens* (Moq.) C.C. Townsend, Plate 56a) are recognised based on the shape and indumentum of the leaves and size of flowers. Both varieties are recorded from Oman, but since there are many intermediary forms (of leaf shape, indumentum and flower size), it is difficult to assign the two taxa for Oman material.

# 8. **Alternanthera** Forssk.

80 species, distributed in the tropical and warm regions of the world.

*Alternanthera pungens* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. 2: 206 (1818).

*Description:* Perennial herb, with a small woody rootstock. Stems prostrate to ascending, up to 20 cm, rooting at the lower nodes, striate, villous. Leaves subopposite, purplish, 15–40 × 5–15 mm, broadly ovate to rhomboid-ovate. Flowers sessile, in axillary globose clusters; bracts 4–5 mm, membranous, pilose, with an excurrent midrib; perianth of 5 unequal segments, the outer 2 longer ( $\pm$  5 mm) than the inner ( $\pm$  3 mm), mucronate with a spiny mucro; staminodes shorter than the stamens. Capsule globose, rounded or retuse above.

*Flowering and fruiting:* March to May; September, October.

*Distribution and habitat:* Southern Oman, Dhofar, in cultivated, irrigated and disturbed places. *Altitude:* 20–50 m. Native of tropical America now widespread in the tropics and subtropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 82. *Illustration:* Plate 57.

*Notes:* The species was not recorded to be common in Dhofar, but recently (1999, 2002) I have seen it widespread on disturbed ground near and around Salalah and in villages on the Dhofar hills.

## 17. **Portulacaceae**

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### Key to the genera of Portulacaceae in Oman

- A. Herbs with erect stems up to 1 m. Flowers pink-purple. Ovary superior. . . .1. **Talinum**
- A\*. Herbs with prostrate to ascending stems up to 30 cm. Flowers yellow. Ovary inferior or half-inferior . . . . .2. **Portulaca**



1. **Talinum** Adans.

50 species, distributed in the warm regions of N America (especially Mexico), Africa and Asia.

*Talinum portulacifolium* (Forssk.) Asch. ex Schweinf., Bull. Herb. Boiss. 4, App. 2: 172 (1896).

Synonyms: *Orygra portulacifolium* Forssk. (1775).

vernacular names: zerkhiş (Jibbālī).

*Description*: Perennial herb, reaching up to 1 m, with a thick or woody root-stock. Stems thick, somewhat succulent, erect to ascending. Leaves opposite to subopposite, 2–6(–8) × 1–3 cm, obovate to spatulate, somewhat fleshy, apex rounded to obtuse, mucronate at the tip, base cuneate, glabrous. Flowers pink-purple, 2–2.5 cm across, in terminal racemes; sepals 4–6 mm, ovate, concave, membranous, apiculate; petals 9–12 mm, obovate; stamens many. Capsule globose, 5–7 mm in diameter, opening by 3 valves, many-seeded.

*Flowering and fruiting*: September, October.

*Distribution and habitat*: Southern Oman, Dhofar, in the wet escarpment woodlands, in shaded and moist locations. Distributed in Africa, India. *Altitude*: 50–500 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 83. *Illustration*: Plates 58, 59.

2. **Portulaca** L.

40 species, distributed in the tropical and warm regions of the world.

A. Leaves obovate, 5–10 mm wide; stipular hairs few . . . . .1. **P. oleracea**

A\*. Leaves oblong, ovate-oblong or elliptic, 2–3 mm wide; stipular hairs numerous

B. Stems rooting at the nodes. Leaves ovate-oblong, margins not in-rolled. Roots not tuberous . . . . .2. **P. quadrifida**

B\*. Stems not rooting at the nodes. Leaves elliptic, margins often in-rolled. Roots tuberous . . . . .3. **P. dhofarica**

1. *Portulaca oleracea* L., Sp. Pl. 445 (1753).

*Vernacular names*: barbu, baklali, mijlah, riglah; hamzut (Jibbālī); hamdeh (Zitani Arabic).

*Description*: Annual herb, up to 20 cm. Stems thick and succulent, decumbent to ascending. Leaves succulent, opposite to subopposite or alternate, 10–20 × 5–10 mm, obovate, apex rounded or notched, base cuneate, sessile, stipular hairs few. Flowers yellow, solitary or 2, terminal or subterminal; sepals 2–4 mm, oblong-ovate, united below; petals 4–7 mm, obovate, often notched at the apex. Capsule opening transversely, many-seeded. Seeds minutely tuberculate with star-shaped tubercles.

*Flowering and fruiting*: More or less throughout the year.

*Distribution and habitat*: Throughout Oman, as a weed of cultivated areas and farmlands, by roadsides, waste places and irrigated tree pits. *Altitude*: 0–2000 m. Widespread in the tropics and subtropics. Elsewhere in the Arabian Peninsula, weedy and widespread in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 84.

*Notes*: *P. oleracea* is a polyploid complex with diploid, tetraploid and hexaploid forms. Damm et al. (1974, Israel J. Bot., vol. 27) have recognized 9 subspecies based on size of seed, sculptur-

ing of testa and level of ploidy. The Oman plants fall under subsp. *oleracea* recognized by the stellate seeds cells, each with a central tubercle, and a tuberculate seed periphery. Chromosome number  $2n=54$ .

**2. *Portulaca quadrifida* L., Syst. Nat. ed. 12, 2: 328 & Mant. 73 (1767).**

*Vernacular names:* farfina, oşot eshekherit (Jibbali), satar al 'yuz (Jibbali), zerkiş (Jibbali).

*Description:* Annual herb. Stems prostrate, fleshy, up to 20 cm, rooting at the nodes. Leaves opposite,  $3-10 \times 2-3$  mm, ovate-oblong, fleshy and flattened, sessile to subsessile; stipular hairs numerous, white, persistent. Flowers solitary, yellow, subtended by an involucre of 4 leaves and white-silvery hairs; sepals 2–4 mm, triangular, united below; petals yellow or pink; stamens inserted at the base of the corolla. Capsule 3–4 mm, oblong-conical. Seeds minutely tuberculate.

*Flowering and fruiting:* April; September, October.

*Distribution and habitat:* Throughout Oman, in disturbed and waste places, wadi beds and on rocky slopes. *Altitude:* 0–1000 m. Weedy and widespread in tropical Africa and Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 85. *Illustration:* Plate 60.

**3. *Portulaca dhofarica* Gilbert, Kew Bull. 55: 788–789 (2000).**

*Type:* Oman, Dhofar, north of Jebel Qamar, 28 Aug. 1982, R.M. Lawton 2390 (holotype K, isotype ON).

*Description:* Tufted annual herb, up to 5 cm. Stems branched, ascending, thick and succulent, arising from a tuberous root. Leaves whorled, 3–5 at each node, sessile, glabrous,  $3.5-5.5 \times 2-3$  mm, elliptic to oblong-elliptic, apex acute, margins often in-rolled, dense tufts of white hairs present in leaf axils, hairs up to 4 mm long. Flowers sessile,  $\approx 1$  cm wide, in few-flowered terminal clusters, subtended by an involucre of 4 leaves and dense white-silvery hairs; involucre bracts 3–3.5 mm, elliptical, glabrous; sepals 2, 2.5–3 mm, ovate-elliptic, glabrous, 10-nerved; petals 4, pale-yellow, 3–3.5 mm, obovate, notched at the apex, stamens 10; filaments 2–2.5 mm, adnate below to the petals; style 1, c. 1 mm, divided above into 5 branches. Capsule  $3 \times 2.5$  mm, ovoid-conical, brown and membranous when mature, dehiscing by an apical lid at the point of insertion of the petals and sepals. Seed reniform, 0.5–0.75 mm long, dark brown, tuberculate.

*Flowering and fruiting:* July to August.

*Distribution and habitat:* Endemic to Dhofar, on hill slopes of the coastal escarpment and seaward facing wadis, at the edge of the monsoon zone, growing amongst rocks and stones. *Altitude:* 170–220 m.

*Distribution map:* Fig. 86. *Illustration:* Plates 61, 62, 62a.



## 18. Molluginaceae

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## Key to the genera of Molluginaceae in Oman

- A. Leaves in a basal rosette; stem leaves, when present, whorled . . . . .3. **Mollugo**  
 A\*. Leaves not in a basal rosette; leaves opposite to sub-opposite  
 B. Stems glandular-hairy. Fruit splitting into 1-seeded mericarps. . . . .1. **Linum**  
 B\*. Stems stellate-hairy. Fruit not splitting into 1-seeded mericarps. . . . .2. **Glinus**

1. **Linum**

23 species, distributed from S Africa to E and N Africa.

- A. Plant with ascending stems. Mericarps reticulately rugose. . . . .1. **L. arabicum**  
 A\*. Plant with prostrate stems. Mericarps smooth. . . . .2. **L. obovatum**

1. *Linum arabicum* Friedrich, Mittl. Bot. Staatssamml. München 2: 156 (1956).

*Description*: Annual herb or a perennial subshrub, up to 50 cm. Stems ascending, somewhat zig-zag, branching intricate, glandular-hairy (often with sand sticking on the stems and leaves). Leaves opposite to sub-opposite, 2–10 × 2–8 mm, ovate to elliptic to broadly ovate, apex obtuse or apiculate. Flowers 1–2, sessile, axillary, white; petals 0; sepals c. 5 mm, ovate; stamens 7; staminodes petaloid. Fruit 2–3 mm, recurved, reticulately rugose, splitting into 1-seeded mericarps, light brown.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, in sandy wadis, on low stabilised sand dunes. *Altitude*: 50–550 m. Endemic to the Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 87.

*Notes*: Of the two species of *Linum* in Oman, this species is the least common. I have collected it from the eastern dunes of the Wahibah Sands and the low sand dunes at the base of the hills on the Bahrah. The name of this species is based on material collected from Yemen by Popov et al. 4195 (BM, K).

2. *Linum obovatum* Vicary, J. Asiat. Soc. Bengal 16: 1163 (1847).

*Vernacular names*: kibdenīt (Ḥarsūsī).

*Description*: Plant similar to *Linum arabicum*, but with prostrate stems, sepals 3–4 mm long and smooth mericarps.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern and central Oman, in sandy and gravelly locations, flood plains and wadi beds. *Altitude*: 0–650 m. Distributed in SW and NE Africa, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 88.

*Notes*: More widespread in Oman than the previous species.

2. *Glinus* L.

6 species, distributed in the warm regions of the world.

*Glinus lotoides* L., Sp. Pl. 463 (1753).

*Synonyms*: *Mollugo lotoides* (L.) O. Kuntze (1891); *Mollugo glinus* A. Rich. (1847).

*Description*: Annual herb, up to 10 cm. Stems decumbent to prostrate, with soft, stellate hairs. Leaves opposite, elliptic to obovate, 8–40 × 5–20 mm, apex obtuse or rounded, base cuneate, margins sinuate. Flowers in congested, axillary cymes; pedicels 1–6 mm; sepals 5, accrescent, 5–8 mm, tinged pink, stellate-pubescent; petals absent; stamens many, staminodes linear, white, c. 15 in number, 2-fid at the apex. Capsule ± 5 × 3 mm, subglobose.

*Flowering and fruiting*: September–October.

*Distribution and habitat*: Southern Oman, Dhofar, in disturbed and moist shaded locations, irrigated fields, rocky and silty slopes. Common. *Altitude*: 20–400 m. Distributed in the tropics and subtropics. Elsewhere in the Arabian Peninsula widespread in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 89.

3. *Mollugo* L.

About 35 species, distributed in the warm tropical and temperate regions.

*Mollugo cerviana* (L.) Seringe in DC., Prodr. 1: 392 (1824).

*Synonyms*: *Pharnaceum cervianum* L. (1753); *Pharnaceum umbellatum* Forssk. (1775).

*Description*: Delicate annual herb, up to 10 cm. Branches erect to ascending, rigid. Lower part of stem usually leafless with the leaves withering soon, upper leaves in whorls. Cauline leaves 5–18 mm, linear. Flowers in 1–4-flowered, terminal and axillary, umbellate cymes, sessile or pedunculate; sepals 1–3 mm, green with white margins, persistent; petals absent; stamens 5. Capsule dehiscent by 3 valves.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, in sandy areas, on moist and shaded, sandy soils. *Altitude*: 10–150 m. Distributed in the tropics and subtropics of the Old World. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.



*Distribution map:* Fig. 90.

*Note:* This species is not reported from Oman in Miller & Cope (1966). It has however been collected from the desert wadi of Al Batha in Wahibah Sands. As is the case with several short-lived desert annuals, this species may not come up until there is good rain, and, it is possible that rain may not occur for several years in the eastern dune desert of Wahibah Sands.

## 19. Caryophyllaceae

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### Key to the genera of Caryophyllaceae in Oman

(Adapted from King & Kay, 1984)

- A. Inflorescences with bracts modified into hair-like structures, very conspicuous in fruit ..... 1. **Cometes**
- A\* Inflorescences with bracts not modified into hair-like structures
- B. Leaves with stipules
- C. Small shrubs with woody branches
- D. Sepals with a thick green midrib prolonged into an soft spine-tipped awn, recurved at the tip. .... 3. **Sphaerocoma**
- D\* Sepals not as above
- E. Sepals equal, each with a mucronulate apex. Petals absent .2. **Gymnocarpus**
- E\* Sepals unequal (the outer 2 larger), fleshy. Petals present ..... 8. **Xerotia**
- C\*. Herbs, not woody

- E. Inflorescence becoming hard and spinescent in fruit (indurate) .....4. **Sclerocephalus**
- F\*. Inflorescence not as above
  - G. Bracts silvery-white, completely scarious, conspicuous .....4. **Paronychia**
  - G\*. Bracts green or brown, sometime with scarious margins
    - H. Plant with prostrate stems. Leaves less than 9 mm. ....6. **Herniaria**
    - H\*. Plants with erect to ascending stems. Leaves more than 9 mm.
      - I. Sepals keeled at the back, hooded .....9. **Polycarpon**
      - I\*. Sepals not keeled at the back
        - J. Stipules connate (surrounding the node). ....11. **Spergularia**
        - J\*. Stipules free
          - K. Leaves mucronate .....7. **Polycarpaea**
          - K\*. Leaves not mucronate .....10. **Spergula**
  - B\*. Leaves without stipules
    - L. Sepals free to the base
      - M. Leaves filiform. Capsule dehiscing by 3 valves .....12. **Minuartia**
      - M\*. Leaves not filiform. Capsule dehiscing by 4 or more teeth or valves
        - N. Inflorescence in terminal umbels .....13. **Holosteum**
        - N\*. Inflorescence not in terminal umbels
          - O. Petals entire or emarginate .....14. **Arenaria**
          - O\*. Petals deeply bi-fid .....15. **Stellaria**
    - L\*. Sepals fused at the base for at least a third of their length
      - P. Calyx with an epicalyx of bracteoles enclosing the base .....18. **Dianthus**
      - P\*. Calyx without an epicalyx of bracteoles enclosing the base
        - Q. Calyx with commissural veins. Styles 3. Capsule dehiscing by 6 valves or teeth .....16. **Silene**
        - Q\*. Calyx without commissural veins. Styles 2. Capsule dehiscing by 4 valves .....17. **Gypsophila**

# 1. **Cometes** L.

2 species, NE Africa and Ethiopia to NW India.

- A. Leaves obovate to elliptic-obovate (10–25 mm), glabrous to sparsely pubescent .....1. **C. surattensis**
- A\*. Leaves linear to lanceolate (6–12 mm), white-hirsute .....2. **C. abyssinica**

# 1. **Cometes surattensis** L., Mant. pl. 1: 39 (1767).

*Vernacular names:* ḥadat al wa'al, raghāwa.

*Description:* Woody based annual, up to 20 cm, aerial stems dying after spring. Stems erect to ascending, branching, branches spreading, forming a cushion-shaped subshrub. Leaves opposite, 10–25 × 5–9, obovate to elliptic-obovate, surfaces glabrous to densely pubescent. Flowers in terminal cymes. Bracts modified into long hair-like appendages, white to brownish, up to 12 mm in fruit; sepals 3–4 mm, oblong, pale yellow-green, with a green midrib; petals white, linear, shorter than the sepals. Capsule indehiscent.

*Flowering and fruiting:* April to March; September.

*Distribution and habitat:* Throughout Oman, in wasteland, disturbed places, by roadsides, flowering after the rains. *Altitude:* 0–900 m. Distributed in Egypt, Iraq, S Iran, S Pakistan.



Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 91. *Illustration:* Plate 63.

2. *Cometes abyssinica* (R. Br.) Wallich, Plant Asiatic. Rar. 1: 18, t. 18 (1830).

*Description:* Woody based annual herb, up to 30 cm. Stems scabrid, ascending, branching at the base, spreading, forming small cushion-shaped plants. Leaves opposite, 6–12 mm, linear to lanceolate, white-hirsute, sometimes leaf fascicles present at the nodes. Flowers in terminal cymes. Bracts with long, white to pale-yellow hairs, the flower clusters appearing as white hairy balls at maturity, bracts elongating to 15 mm in fruit; sepals 3–4 mm, oblong, papillose; petals white, linear, shorter than the sepals by 1–3. Capsule indehiscent.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar and Halaniyah Island, on limestone cliffs on coastal areas and in coastal wadis. *Altitude:* 0–1500 m. Distributed in NE Africa and Ethiopia to NW India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 92.

2. *Gymnocarpus* Forssk.

8 species, distributed in the Canary Islands, N Africa, the Middle East, and Pakistan.

A. Leaves linear-terete ..... 1. *G. decandrus*

A\*. Leaves not linear-terete

B. Leaves elliptic-obovate to orbicular, petiolate, leaf-base attenuating into the petiole ..... 2. *G. rotundifolius*

B\*. Leaves linear-ob lanceolate to suborbicular, sessile ..... 3. *G. dhofarensis*

1. *Gymnocarpus decandrus* Forssk., Fl. Aegypt.-Arab.: 65 (1775) as '*G. decandrum*'.

*Synonymy:* *Baronvillia decandra* (Forssk.) Rohweder & Urm-König (1975); *Gymnocarpus decandrus* f. *salsoloides* (Webb ex Christ) Chaudhri (1968).

*Description:* Perennial subshrub, woody, up to 50 cm. Stems and branches white, furrowed, glabrous. Leaves opposite, sessile, 6–8 × 1–1.4 mm, linear-terete, fleshy, mucronulate, deciduous; stipules obscurely keeled, membranous, white, ciliate. Flowers small, sessile, 4–5 mm, in terminal clusters (dichasial cymes); bracts foliose, 2–4 mm, mucronulate; sepals 2–3 mm, green or brown to pale-yellow or white, 5-lobed, pilose at the base, apex mucronulate; petals absent; stamens 5, alternating with 5 linear, white staminodes. Fruit 1-seeded, densely papillose, rupturing irregularly. Seeds ellipsoid, dark-brown.

*Flowering and fruiting:* March to May.

*Distribution and habitat:* Northern Oman, in the lower hills and foothills of the mountains, gravel and rocky slopes and in stony gorges. *Altitude:* 20–650 m. Distributed in N Africa, Canary Islands, Palestine, Jordan, S Iran, SW Afghanistan, SW Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map:* Fig. 93. *Illustration:* Plate 64.

*Notes:* The flowers are faintly fragrant. The name of this species is based on material collected from Egypt by P. Forsskål (lectotype C).

2. *Gymnocarpus rotundifolius* Petruss. & Thulin, Edinb. J. Bot. 53: 19 (1996).

*Type:* Oman, Dhofar, gravel plain W of Sawqirah, 29.iv.76, A.G. Miller 6476 (holotype E, isotypes K, UPS).

*Description:* Subshrub, woody, up to 25 cm. Branches erect to spreading, bark grey to grey-brown. Leaves opposite, 2–5 × 1.5–3.5 mm, elliptic-obovate to orbicular, apex obtuse, mucronulate, base attenuating into a long petiole; stipules obscurely keeled, white-brown. Inflorescence many-flowered; bracts foliose, 4–5 mm, broadly ovate, white with a brown base. Flowers 4.5–5.5 mm, sessile; sepals 2.5 mm, green, margin white-membranous, ciliate at the base, mucronulate; petals absent; staminodes ± 1 mm, narrowly triangular with concave sides.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, on open, dry limestone rocky areas, coastal sand dunes and gravel plains, occurring on the Sahil al Jazir coast and the limestone plateau above. *Altitude:* 20–100 m. Endemic to Oman.

*Distribution map:* Fig. 94.

*Notes:* The species is endemic to Oman and restricted in its distribution to eastern Dhofar.

3. *Gymnocarpus dhofarensis* Petruss. & Thulin, Edinb. J. Bot. 53(1): 15 (1996).

*Type:* Oman, Dhofar, main Salalah to Thamrait rd., 4.x.1976, A.G. Miller 2524 (holotype E, isotype K).

*Description:* Subshrub, woody, up to 45 cm. Branches erect to spreading, bark white to grey. Leaves opposite, sessile, 3–12 × 1–3 mm, linear-oblongate to suborbicular, mucronulate; stipules triangular, with white margins. Inflorescence terminal or subterminal, many-flowered; bracts foliose, 4–5 mm, brown with a white margin, glabrous. Flowers ± 5 mm, sessile; sepals 2–3 mm, glabrous or puberulous at the apex, mucronulate; petals absent; staminodes narrow-triangular with concave sides.

*Flowering and fruiting:* September to December.

*Distribution and habitat:* Southern Oman, Dhofar, on sparsely vegetated open rocky slopes. *Altitude:* 500–1300 m. Endemic to Dhofar and E Yemen. Elsewhere in the Arabian Peninsula found in E Yemen.

*Distribution map:* Fig. 95.

*Notes:* A regionally endemic species present on the rocky mountain slopes of western Dhofar and eastern Yemen.

### 3. *Sphaerocoma* T. Anderson

2 species, distributed from Egypt and SE Arabia east to Pakistan.

*Sphaerocoma aucheri* Boiss., Fl. Or. 1: 739 (1867).

*Description:* Perennial subshrub, 20–50 cm. Stems grey-white, white scruffy, becoming glabrescent with age. Leaves in clusters at the nodes, 4–10 × 1–2 mm, linear to elliptic to terete, fleshy; stipules triangular, brown. Flowers in dense clusters, up to 15 mm across; peduncle stout, 5–6 mm; sepals 5, 2–2.5 mm, ovate, free, with broad scarious margins and a thick green midrib.



prolonged into a soft spine-tipped awn, recurved at the tip; petals white, shorter than the sepals; stamens 5. Fruit 1-seeded, indehiscent.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, including Musandam, and Masirah Island, on sandy and gravelly coastal plains and gravelly coastal wadis. *Altitude*: 0–100 m. Distributed in S Iran, S Pakistan, Sudan. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 96. *Illustration*: Plate 65.

*Notes*: A typical coastal species, an element of the Nubo-Sindian phytochorion, present in northern Oman (but not extending into Dhofar). The name of this species is based on material collected from southern Iran by P.R.M. Aucher-Eloy 4520 (syntypes G-Boiss, P).

#### 4. *Paronychia* Miller

110 species, cosmopolitan in distribution, especially in the Mediterranean region.

*Paronychia arabica* (L.) DC. in Lam., Encycl. 5: 24 (1804).

*Description*: Annual or perennial herb. Stems prostrate, up to 40 cm, pilose. Leaves opposite, sessile, 3–15 × 2 mm, linear-oblong, mucronate, sparsely pubescent; stipules scarious,  $\pm$  3 mm, silvery-white, conspicuous; bracts ovate, scarious, conspicuous. Flowers 2 mm across, in terminal and axillary clusters; sepals 5, equal,  $\pm$  1.5 mm, with broad scarious margins, concave and awned at the apex, persistent; petals absent; stamens 5. Fruit  $\pm$  1 mm, oblong-ovoid, 1-seeded, indehiscent, densely papillose above, rupturing irregularly at the base.

*Flowering and fruiting*: March to June.

*Distribution and habitat*: Northern Oman, including Musandam, on sandy, silty and stony places, and in sandy and gravelly water courses. *Altitude*: 0–250 m. Distributed in N Africa, S Iraq, S Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen.

*Distribution map*: Fig. 97.

#### 5. *Sclerocephalus* Boiss.

A single species, distributed from Macronesia to Iran and Arabia.

*Sclerocephalus arabicus* (Decne.) Boiss., Diagn. ser. 1, 1 (3): 12 (1843); Fl. Or. 1: 748 (1867).

*Type*: [Oman], Mascate, Aucher-Eloy 4513 (syntypes K, G-Boiss.)

*Synonyms*: *Paronychia sclerocephala* Deene. (1835).

*Description*: Annual herb, 5–15 cm. Stems prostrate to ascending, glabrous. Leaves opposite, sessile, 5–12 mm, subicrete, apex with a small brown spine; stipules scarious. Flowers in globose heads, indurate when mature; bracts similar to leaves, indurate; sepals 2–3 mm, spine-tipped, indurate, woolly, adnate to the bracts; petals absent. Capsule  $\pm$  3 mm, enclosed within the indurate calyx.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, in the foothills of the northern mountains, in rocky and sandy areas, and gravelly and sandy wadis. *Altitude*: 0–1000 m. Distributed in W Iran,

Iraq, Egypt, NE Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 98.

6. **Herniaria** L.

20 species, distributed in Europe, and from Africa to India.

- A. Stems not brittle. Leaves ovate to ovate-lanceolate, hirsute, not glandular. 1. **H. hirsuta**
- A\*. Stems brittle. Leaves broadly obovate to orbicular, densely pubescent, glandular.  
..... 2. **H. maskatensis**

1. **Herniaria hirsuta** L., Sp. Pl. 218 (1753).

*Description:* Annual herb. Stems prostrate, up to 10 cm, branching from the base, hirsute. Leaves opposite or alternate, grey-green, 0.5–10 mm, ovate to ovate-lanceolate, hirsute; stipules scarious. Flowers sessile, minute, in axillary clusters of 6–9; sepals 5, lobed above, 1–2 mm, white-hirsute; petals shorter than the calyx; staminodes filiform. Fruit 1-seeded, ovoid to subglobose.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in the foothills and wadi beds, amongst rocks and stones and in cultivated areas. *Altitude:* 20–2000 m. Distributed in Europe, Asia (except in the north), N Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE.

*Distribution map:* Fig. 99.

2. **Herniaria maskatensis** Bornm., Mitth. Thuring. Bot. Vereins 6: 51 (1894).

*Type:* Oman, Bornmüller 181 (B, G, JE).

*Vernacular names:* kibdenīt (Ḥarsūsī).

*Description:* Annual herb. Stems prostrate, up to 7 cm, lying flat on the ground, brittle, pubescent. Leaves opposite, 2–3 × 1.5–2 mm, broadly obovate to orbicular, densely pubescent, glandular; stipules brown, membranous. Flowers sessile, minute, in leaf-opposed, axillary clusters; sepals 5, equal, ± 1 mm, ovate-oblong; stamens 5; staminodes 5, triangular. Fruit 1-seeded, subglobose.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern and central Oman and Dhofar, on pockets of sand on sandy and stony places, coastal and inland gravel plains. *Altitude:* 0–400 m. Endemic to Oman and Yemen (S).

*Distribution map:* Fig. 100. *Illustration:* Plates 66, 66a.

*Notes:* A regional endemic, not common in Oman.

7. **Polycarpacea** Lam.

52 species, distributed in the tropical and warm regions of the world, especially in the Old World.

- A. Leaves forming a basal rosette
- B. Inflorescence sessile. Cauline leaves present. Petals narrow-ovate to linear



- .....2. **P. spicata**
- B\* Inflorescence pedunculate. Cauline leaves absent. Petals differentiated into a limb and claw .....4. **P. robbairea**
- A\* Leaves not forming a basal rosette
- C. Annual, white-pubescent. Flowers in terminal and axillary cymes .....1. **P. repens**
- C\*. Woody based perennial with a swollen rootstock, glabrous. Flowers in dense, 2–4-spicate heads .....3. **P. jazirensis**

1. *Polycarpaea repens* (Forssk.) Aschers & Schweinf., in Ostenf. Bot. Zeit. 39: 26 (1889).  
Synonyms: *Corrigiola repens* Forssk. (1775).  
Vernacular names: gizhah.

Description: Annual or perennial herb, 10–20 cm. Stems woody at the base, prostrate to ascending, white-pubescent. Leaves opposite or whorled, 3–10 × 1–2 mm, lanceolate-linear, mucronate, margins revolute, stipules 4.5–5 mm, ovate to narrow ovate, acuminate. Flowers small, in terminal and axillary cymes; bracts similar to stipules; sepals 1.5–2 mm, lanceolate with a hyaline margin; petals 5, white. Capsule ovoid, 3-valved.

Flowering and fruiting: January to March.

Distribution and habitat: Northern Oman, in sandy and gravelly places, on the swales of the eastern sand desert. Common annual after rain. Altitude: 0–800 m. Distributed from Africa eastwards to Pakistan. Widespread in the Arabian Peninsula and found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen, ?UAE. Also found in Soqatra.

Distribution map: Fig. 101. Illustration: Plate 67.

Notes: Reported to occur in the sandy desert between the Oman–UAE border, but I have not seen any collections from that area.

2. *Polycarpaea spicata* Wight & Arn., Ann. Nat. Hist. ser. 1 (3): 91 (1831).

Description: Short-lived perennial, or an annual herb, up to 10 cm. Stems branching from the base, erect to ascending, glabrous. Basal leaves forming a rosette, cauline leaves in whorls, 5–25 × 2–8 mm, obovate-spatulate to linear, mucronate, glaucous; stipules ± 1.5 mm, ovate-oblong. Flowers small, in dense spicate cymes; inflorescence sessile; bracts + 2 mm, somewhat brownish; sepals ovate to lanceolate, 3.5–4 mm, green-brown, with a prominent mid-rib; petals white, with a lacerate margin. Capsule narrow ovoid, smaller than the sepals.

Flowering and fruiting: February to April; September, October.

Distribution and habitat: Throughout Oman, including the offshore islands Masirah and Al Hakeemiyah, in sandy and gravelly places, coastal wadis, open gravelly places and grassland. Altitude: 0–600 m. A common annual after rain. Distributed in Egypt, E Africa, S Iran, Pakistan, India. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map: Fig. 102. Illustration: Plate 68.

Notes: Two subsp. are recognized: *P. spicata* var. *spicata*, distributed throughout the Arabian Peninsula, and *P. spicata* var. *capillaris* Balf.f., distributed in Soqatra where it is endemic. The difference in the two varieties is in the shape of the cauline leaves and width of the midrib of the sepals. In the former, the leaves are spatulate and the midrib broad, while in the latter, the leaves are linear and the midrib narrow.

3. *Polycarpaea jazirensis* R.A. Clement, Edinb. J. Bot. 51(1): 53–54 (1994).

*Type*: Oman, Dhofar, A.G. Miller 6470 (holotype E).

*Description*: Woody based perennial with a swollen rootstock. Stems erect, 5–9 cm. Leaves slightly fleshy, tufted at the base, appearing whorled above, 3–10 × 3–6 mm, spatulate to sub-orbicular, mucronate; stipules minute, broadly ovate. Flowers in dense, 2–4-spicate heads; bracts triangular; sepals ovate-oblong,  $\pm$  2.5 mm, with a broad midrib; petals shorter than the sepals, margin dentate towards the base. Capsule elliptic.

*Flowering and fruiting*: March, April.

*Distribution and habitat*: Southern Oman, eastern Dhofar, on the coastal areas of Sahil al Jazir, in sandy depressions and on limestone cliffs. Not common. *Altitude*:  $\pm$  150 m. Endemic to Oman.

*Distribution map*: Fig. 103.

*Notes*: The species is rare and has been collected only once from eastern Dhofar. The area where this species is found is not well explored, and therefore it may be under-collected.

4. *Polycarpaea robbairea* (Kuntz) Greuter & Burdet, Willdenowia 12: 189 (1982).

*Synonyms*: *Robbairea prostrata* (Forssk.) Boiss. (1867) pro parte, excl. nom. et syn. Forssk.; *Polycarpon* [= *Polycarpa*] *robbairea* Kuntze (1891); *Robbairea delileana* Milne-Redhead (1948).

*Description*: Annual herb, up to 20 cm. Stems prostrate to ascending, repeatedly branching, glabrous. Leaves forming a basal rosette, absent on the flowering stems, 10–12 × 3–4 mm, obovate to oblong to linear-oblong, glabrous; stipules triangular,  $\pm$  1 mm, membranous. Flowers minute, in lax cymes; pedicels up to 2 mm; bracts scarious with a green midrib; sepals 2–3 mm, ovate-elliptic, with a scarious margin; petals 5, pinkish, limb broadly ovate, claw short, equalling the sepals. Capsule subglobose, 3-valved.

*Flowering and fruiting*: March, April; September, October.

*Distribution and habitat*: Throughout Oman, in sandy and gravelly habitats and in cultivated areas. *Altitude*: 20–1800 m. Distributed in N Africa, Sudan, and Palestine. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 104. *Illustration*: Plate 69.

8. *Xerotia* Oliver

A single species, endemic to Arabia.

*Xerotia arabica* Oliver in Hk., Icon. Pl. 24, t. 2359 (1895).

*Description*: Small subshrub. Stems arising from a woody rootstock, apparently dying back after the growing season, grey-green. Leaves sessile, in whorls at the nodes, 7–10 × 2–3 mm, oblong to oblong-obovate, glabrous, succulent. Stipules minute, scarious, ovate, fimbriate. Flowers minute, in terminal cymes; bracts scarious, ovate-lanceolate; sepals 5,  $\pm$  1 mm, fleshy; petals  $\pm$  1 mm, white; stamens 5. Capsule ovoid, 3–6 seeded, exerted from the calyx, splitting by 3 valves.

*Flowering and fruiting*: May.



*Distribution and habitat:* Central Oman and Dhofar, on the coasts of Sahil al Jazir, and on the central limestone plateau. *Altitude:* 0–150 m. Regionally endemic to central Oman, Dhofar and E Yemen. Elsewhere in the Arabian Peninsula found in Yemen (S).

*Distribution map:* Fig. 105.

*Notes:* A regionally endemic species. In Oman the species is known only from a few collections where it is fairly widespread but never common. More data is required on its flowering times and distribution in Oman. The name of this species is based on material collected from Yemen by W. Lunt 82 (isotypes E, K).

## 9. *Polycarpon* L.

17 species, cosmopolitan in distribution.

- A. Leaves linear-lanceolate, not succulent. Sepals mucronate at apex . . . 1. *P. tetraphyllum*  
 A\*. Leaves linear to linear-oblong to linear-spatulate, succulent. Sepals obtuse at apex  
 . . . . . 2. *P. succulentum*

### 1. *Polycarpon tetraphyllum* (L.) L., Syst. nat. ed. 10 (2): 881 (1759).

*Synonyms:* *Mollugo tetraphylla* L. (1753).

*Description:* Annual herb. Stems 5–10 cm, prostrate to ascending, glabrous. Leaves opposite, 3–6 × 1–2 mm, linear-lanceolate; stipules ± 2 mm, white, membranous. Flowers small, in congested to lax, axillary cymes; bracts scarious; sepals 2.5–3 mm, keeled at the back, hooded, margins scarious, apex acute and mucronate; petals white, smaller than the calyx; stamens 3. Capsule ovoid, 3-valved, included in the calyx.

*Flowering and fruiting:* March, April.

*Distribution and habitat:* Northern Oman, Musandam, in sandy and gravelly places, and as a weed of irrigated and cultivated areas. *Altitude:* 0–1200 m. Distributed in W and C Europe, Mediterranean area, Syrian desert, N Iran. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, Yemen.

*Distribution map:* Fig. 106.

### 2. *Polycarpon succulentum* J. Gay, Rev. Bot. Bull. Mens. 2: 372 (1846).

*Description:* Annual herb. Stems 2–5 cm, prostrate to ascending, glabrous. Leaves opposite, ± 4 × 1–5 mm, linear to linear-oblong to linear-spatulate, succulent; stipules ± 2 mm, white, membranous. Flowers small, in congested to lax, axillary cymes; bracts scarious; sepals 3 mm, keeled at the back, hooded, margins scarious, apex obtuse; petals white, smaller than the calyx; stamens 3.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern and central Oman, in sandy and coastal places. *Altitude:* 0–300 m. Distributed in Egypt, Sinai, Lebanon, Palestine, Iraq. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia.

*Distribution map:* Fig. 107.

*Notes:* This species is not common in Oman, however it is reported to be widespread along the coasts of Arabia.

## 10. *Spergula* L.

6 species, distributed in temperate Europe.

*Spergula fallax* (Lowe) Krause in Sturm, *Deutschl. Fl.* ed. 2, 5: 19 (1901).

*Synonyms*: *Spergularia fallax* var. *pentandra* Boiss. (1853); *Spergularia fallax* Lowe (1856).

*Description*: Delicate annual herb. Stems 5–15 cm, ascending, branching from the base, glabrous. Leaves opposite, apparently whorled, with secondary fascicles in the axils, sessile, 10–40 mm, linear; stipules white, scarious. Flowers in lax terminal cymes; pedicels 5–10 mm. Bracts with scarious margins; sepals 3–4 mm, lanceolate, with white hyaline margins; petals white, about as long as the sepals. Capsule 4–5 mm across, subglobose. Seeds with a broad membranous wing.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, including Musandam, in sandy soils, wadi fans, by roadsides and as a weed of cultivated and irrigated places. *Altitude*: 0–1200 m. Distributed in SW Asia, Arabia, N Africa, Canary Island and the Mediterranean region. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 108. *Illustration*: Plate 70.

*Notes*: A short-lived annual, coming up after rain.

## 11. *Spergularia* (Pers.) J. Presl. & C. Presl.

About 25 species, cosmopolitan in distribution.

A. Capsule not exceeding the calyx. Seeds finely tuberculate, never winged. 1. *S. bocconii*

A\*. Capsule exceeding the calyx. Seeds winged or unwinged, smooth, rugulose or prominently tuberculate

B. Seeds dark brown, rugulose or prominently tuberculate ..... 2. *S. diandra*

B\*. Seeds pale brown, smooth, winged or unwinged ..... 3. *S. marina*

1. *Spergularia bocconii* (Scheele) Graebn. in Aschers & Graebn., *Syn. Mittel. eur. Fl.* 5(1): 849 (1919).

*Synonyms*: *Arenaria bocconii* Sol. (1825), nom. nud.; *Alsine bocconii* Scheele (1843).

*Description*: Annual or biennial herb. Stems up to 10 cm, erect, branching from the base, glandular-hairy. Leaves opposite, 10–30 × 1 mm, linear; stipules  $\leq$  2 mm, white-scarious, connate. Flowers in dichasial cymes; pedicels 3–4 mm, filiform; sepals 2–3 mm, with white-scarious margins; petals pink, with darker pink tips, shorter than or equalling the sepals. Capsule 3–4 mm, shorter than the sepals, opening by 3 valves. Seeds unwinged, pale brown, finely tuberculate.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, including Musandam, in moist and shaded, sandy places, and in irrigated and cultivated areas. *Altitude*: 0–1800 m. Distributed in the Mediterranean region; introduced elsewhere. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 109.



2. *Spergularia diandra* Guss., Heldr. et Sart. in Heldr., Herb. Graec. Norm. no. 492 (1855).  
*Synonyms:* *Arenaria diandra* Guss. (1827).

*Description:* Annual or sometimes a biennial herb. Stems up to 15 cm, ascending, several branching from the base, glandular-pubescent. Leaves opposite, 15–30 × ± 1 mm, linear to filiform; stipules 1 mm, white-scarious, connate. Flowers in terminal cymes; pedicels 3–4 mm; sepals 2–3 mm, with scarious margins; petals pink to light purple, more or less equalling the petals. Capsule 2–3 mm, ovoid, slightly exceeding the calyx, 3-valved. Seeds dark brown, unwinged, rugulose to prominently tuberculate.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman including Musandam, in sandy places, and in coastal and saline areas. *Altitude:* 0–850 m. Distributed in S Europe, N Africa, SW and C Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 110.

*Notes:* A delicate annual herb, widespread in the Arabian Peninsula, coming up after rain. Not common in Oman, but perhaps under-collected.

3. *Spergularia marina* (L.) Gris., Spic. 1: 213 (1843).

*Synonyms:* *Arenaria rubra* L. var. *marina* L. (1753); *Spergularia marina* (L.) Griseb. (1843).

*Description:* Annual or sometimes a biennial herb. Stems up to 20 cm, ascending, several branching from the base, glandular-pubescent. Leaves opposite, 20–40 × 1 mm, linear to filiform; stipules ± 2 mm, white-scarious, connate. Flowers in terminal dichasial cymes; pedicels 3–4 mm; sepals 3–5 mm, with scarious margins; petals pink, equalling the calyx. Capsule ovoid, exceeding the calyx, 3-valved. Seeds pale brown, smooth, unwinged or winged seeds in the same capsule.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, Musandam, as a weed of cultivated and irrigated places and of waste ground. Possibly also present in the foothills of the northern mountains in cultivated and irrigated places but over-looked. *Altitude:* 0–800 m. Throughout the warmer regions of the northern hemisphere. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 111.

## 12. *Minuartia* L.

About 100 species, distributed from the Arctic to Mexico, Chile, Europe, Asia, Arabia, Ethiopia.

A. Stems glabrous. Pedicels 4–5 mm . . . . . 1. *M. hybrida*  
 A\*. Stems glandular-pubescent. Pedicels 2–3 mm . . . . . 2. *M. meyeri*

1. *Minuartia hybrida* (Vill.) Schischk., Fl. URSS 6: 488 (1936).

*Synonyms:* *Arenaria hybrida* Vill. (1779).

*Description:* Annual herb. Stems 6–10 cm, erect, slender, glabrous. Leaves opposite, 5–20 × 1 mm, tubular to linear, 3-nerved; stipules absent. Flowers in terminal cymes, forming lax clus-

ters; pedicels 4–5 mm; bracts green with a broad hyaline margin; sepals 5, 3–4 mm, narrowly-ovate, free, 3-nerved, glandular, apex drawn into a spinescent point; petals white, shorter than the sepals. Capsule narrowly ovoid, shorter or longer than the sepals, splitting by 3 valves.

*Flowering and fruiting*: May, June.

*Distribution and habitat*: Northern Oman, in the juniper woodland zone, on open rocky areas, often under rock overhangs. *Altitude*: 1500–2500 m. Distributed in the Mediterranean region, and SW Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 112.

## 2. *Minuartia meyeri* (Boiss.) Bornm., Beih. Bot. Centrabl. 27: 318 (1919).

*Synonyms*: *Alsine meyeri* Boiss. (1849).

*Description*: Annual herb 6–10 cm. Stems erect, glandular-pubescent. Leaves opposite, mostly basal, few on the flowering stems, 10–20 × ± 1 mm, linear to linear-subulate; stipules absent. Flowers in axillary or terminal cymes; pedicels 2–3 mm; sepals 5, 5–7 mm, narrowly-ovate, free, 3–5-nerved, glandular, apex drawn out to an acuminate point; petals white, shorter than the sepals. Capsule narrowly ovoid, shorter than the sepals, splitting by 3 valves.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, Musandam, on open rocky areas. *Altitude*: ± 1500 m. Distributed in SW Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 113.

*Notes*: The species has only been collected from the northern province of Oman, Musandam. Not common, but being an annual, perhaps overlooked.

## 13. *Holosteum* L.

6 species, distributed in the temperate regions, especially Europe.

*Holosteum glutinosum* (Beib.) Fisch. & C. Mey., Ind. Sem. Hort. Petrop. 3: 39 (1839).

*Synonyms*: *Arenaria glutinosa* Bieb. (1808); *Holosteum umbellatum* L. var. *glutinosum* (Bieb.) Gay (1845).

*Description*: Annual herb, up to 15 cm. Stems erect, arising from the base, with glandular hairs. Leaves opposite, glandular-hairy, mostly basal, few on the flowering stems, 6–8 × 1–2 mm spatulate to oblanceolate, apex subacute, base narrowing into the petiole; basal leaves, shortly petiolate, cauline leaves smaller than the basal leaves, sessile; stipules absent. Flowers in terminal umbels; pedicels up to 20 mm, glandular-hairy; sepals 5, 4–5 mm, narrow-ovate, with broad scarious margins; petals white, longer than the sepals; stamens 10. Capsule ovoid, exceeding the sepals, splitting by 6 teeth, curving backwards.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, Musandam, on open rocky areas. *Altitude*: ± 1500 m. Distributed in SW Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 114.

*Notes*: The species has only been collected by the coastal road from Musandam. Not common but perhaps overlooked and under-collected.



14. *Arenaria* L.

About 150 species, mainly in the north temperate regions, Europe.

*Arenaria leptocladus* (Reichnb.) Guss., Fl. Sic. Syn. 2: 824 (1845).

*Synonymy:* *Arenaria verticillifolia* L. var. *leptocladus* Reichb. (1841); *A. foliacea* Turrill (1954).

*Description:* Annual herb, up to 10 cm. Stems erect to decumbent, slender, unbranched, glandular-pubescent. Leaves opposite, 2–6 mm, spatulate to ovate, 3–5-veined; stipules absent. Flowers in terminal dichasial cymes, sepals 5, 2–3 mm, free, margin scarious, 3-veined; petals 5, white, shorter than the sepals; stamens 10. Capsule ovoid-conical, (gradually narrowing above) opening by 6 teeth.

*Flowering and fruiting:* April, May.

*Distribution and habitat:* Northern Oman, in the eastern Hajar mountain range, in the *Olea-Juniper* woodland, amongst rocks and in pockets of soil and under juniper trees. *Altitude:* 900–2500 m. Distributed in S and C Europe, Caucasus, Turkey to Iran, and south to NW Africa, Sudan and Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia. Also found in Soqatra.

*Distribution map:* Fig. 115. *Illustration:* Plate 71.

*Notes:* The Omani material from the Hajar mountains is referable to *A. leptocladus*, differing from the more robust *A. verticillifolia* L. in its distribution and habitat, the latter typically a field weed or a mountain plant.

15. *Stellaria* L.

150–200 species, cosmopolitan in distribution.

*Stellaria media* (L.) Vill., Hist. Pl. Dauphine 3: 615 (1789).

*Synonymy:* *Alsine media* L. (1753).

*Description:* Annual herb. Stems erect to ascending, generally weak, 10–30 cm, glabrous or with two lines of hairs along the length of the stems. Leaves opposite, glabrous, vivid green; leaves 1–3 × 1–2 cm, ovate-lanceolate, apex acute. Flowers in lax dichasial cymes; sepals 5, free, 4–5 mm, ovate, sparsely cillous; petals 2–3 mm, white, deeply bilobed, shorter than the sepals; stamens 5–10. Capsule 6–7 mm, dehiscent by 6 teeth, many-seeded.

*Flowering and fruiting:* February to May; September to October.

*Distribution and habitat:* Throughout Oman, but not common, occurring in irrigated and cultivated places; weedy. *Altitude:* 10–2000 m. A cosmopolitan weed. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

*Distribution map:* Fig. 116.

*Notes:* *Stellaria pallida* (Dumort.) Murb. is also recorded from Oman (Miller & Cope, 1996). The material that I have examined falls under *S. media*.

16. *Silene* L.

About 700 species, distributed mainly in Europe and SW Asia.

- A. Stems and leaves with glandular hairs
  - B. Leaves linear-lanceolate; calyx conical, 25–30-veined. Flowers pink . . . 1. *S. conoidea*
  - B\*. Leaves narrow-elliptic; calyx cylindrical, 10-veined. Flowers white or pale pink . . . 3. *S. villosa*
- A\*. Stems and leaves pubescent or glabrous, but without glandular hairs
  - C. Calyx inflated in fruit. . . . . 2. *S. apetala*
  - C\*. Calyx not inflated in fruit
    - D. Flowers in dichasial cymes; calyx 12–15 mm. Carpophore  $\pm$  8 mm . . . . . 4. *S. austroiranica*
    - D\*. Flowers in one-sided racemes; calyx 9–12 mm. Carpophore 3 mm . . . . . 5. *S. schweinfurthii*

1. *Silene conoidea* L., Sp. Pl. 418 (1753).

*Description:* Annual herb. Stems 10–45 cm, erect, densely pilose, glandular-pubescent above, hairs eglandular below. Leaves 30–80  $\times$  3–10 mm, linear-lanceolate, sessile, apex acute, base clasping, margins entire; stipules absent. Flowers in monochasial or dichasial cymes; pedicels 20–30 mm; calyx conical, 15–25 mm, 25–30-veined, 5-toothed above, teeth 5.5–6 mm, calyx enlarging and becoming inflated in fruit; petals 5, reddish-pink, 25–30 mm, claw 12 mm; stamens 10; carpophore 4 mm in fruit, pubescent. Capsule  $\pm$  15 mm, ovoid, many-seeded, dehiscing by 6 teeth. Seeds reticulate.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in the foothills of the northern mountains, on stony and rocky slopes, in gullies, and amongst stones; also found as a weed of cultivation. *Altitude:* 50–650 m. Circumboreal. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia.

*Distribution map:* Fig. 117.

2. *Silene apetala* Willd., Sp. pl. ed. 4, 2: 703 (1799).

*Description:* Annual herb. Stems 10–25 cm, erect, appressed pubescent. Leaves 20–50  $\times$  3–5 mm, linear-lanceolate, sparsely pilose, upper leaves sessile, basal leaves with short petioles up to 20 mm, apex acute, base clasping, margins entire, leaves decreasing in size upwards; stipules absent. Flowers in lax dichasial cymes; pedicels 5–8 mm, pubescent; calyx cylindrical, 8–10 mm, 10-veined, 5-toothed above, teeth 2–3 mm, with scarious margins, calyx inflated in fruit; petals 5, white, green or tinged pink, 6–8 mm, claw  $\pm$  3 mm, deeply bi-lobed up to the middle; stamens 10; carpophore 3 mm in fruit, glabrous or pubescent. Capsule 4–6 mm, ovoid, many-seeded, dehiscing by 6 teeth. Seeds striate, with marginal wings, rugulose.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, including Musandam, in the foothills of the mountains, on stony slopes, in dry runnels, and amongst stones and rocks. *Altitude:* 450–1200 m. Distributed in the Mediterranean region and in SW Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia. Also found in Soqatra.

*Distribution map:* Fig. 118.



### 3. *Silene villosa* Forssk., Fl. Aegypt.-Arab.: 88 (1775).

**Description:** Annual herbs. Stems 10–20 cm, erect, glandular-pubescent. Leaves 10–40 × 1–6 mm, narrowly elliptic, glandular pilose, upper leaves sessile, basal leaves with a short petiole; stipules absent. Flowers in lax dichasial cymes; pedicels 5–20 mm, glandular-villous; calyx cylindrical, 17–25 mm, 10-veined, 5-toothed above, teeth 2–3 mm, with scarious margins, calyx slightly inflated in fruit; petals 5, white to pink, 12–20 mm, claw 10–12 mm, bi-lobed to about half the length; stamens 10; carpophore up to 10 mm in fruit, glabrous. Capsule  $\pm$  10 mm, ovoid, many-seeded, dehiscing by 6 teeth.

**Flowering and fruiting:** February to April.

**Distribution and habitat:** Northern Oman, Musandam, in gravelly and sandy places. **Altitude:** 50–850 m. Distributed in Palestine, Egypt, W Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

**Distribution map:** Fig. 119. **Illustration:** Plate 72.

**Note:** A second form with decumbent stems, a smaller calyx and the capsule which is pendent when mature is also recorded from Musandam (see explanation in Miller & Cope 1996).

### 4. *Silene austroiranica* Rech. f., Aellen & Estand., Bot. Jahrb. Syst. 75: 349 (1951).

**Description:** Annual herb. Stems 15–30 cm, erect, glabrous to sparsely pubescent. Leaves 20–50 × 1.5–2 mm, linear, pubescent, sessile; stipules absent. Flowers in dichasial cymes; pedicels  $\pm$  12 mm, calyx oblong to turbinate, 12–15 mm, 10-veined, pubescent inbetween the ribs, 5-toothed above, teeth  $\leq$  2 mm, calyx not inflated in fruit; petals 8–12 mm long, claw 6–10 mm, bi-fid into elliptic lobes; carpophore  $\pm$  8 mm, pubescent. Capsule 7.8–8 mm, dehiscing by 6 teeth. Seeds with a shallow groove at the back.

**Flowering and fruiting:** February to April.

**Distribution and habitat:** Northern Oman, in the foothills of the northern mountains, wadi beds and hill slopes. **Altitude:** 50–550 m. Distributed in Iraq, Iran, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

**Distribution map:** Fig. 120. **Illustration:** Plate 73.

**Note:** Apparently similar to *Silene linearis* Decne., and possibly conspecific with it, differing only in the lobes of the petal-claw which are linear in *S. linearis* and broadly elliptic in this species.

### 5. *Silene schweinfurthii* Rohrb., Bot. Zeitung 25: 82 (1867).

**Vernacular names:** yawtīn.

**Description:** Perennial herb, woody at the base. Stems 10–30 cm, arising from the woody base, erect to ascending, with a few branches, lower parts covered with old and withered leaves, appressed pubescent. Leaves 30–45 × 3–6 mm, oblanceolate, glabrous with ciliate margins, upper leaves sessile, basal leaves with short petioles, apex acute, base clasping, margins entire; leaves decreasing in size upwards; stipules absent. Flowers in one-sided racemes, pedicels 5–6 mm, pubescent; calyx cylindrical, 9–12 mm, 10-veined, 5-toothed above, calyx not inflated in fruit; petals 5, white or greenish, 6–8 mm, claw  $\pm$  3 mm, deeply bi-lobed to about the middle; carpophore 8 mm in fruit, pubescent. Capsule 6–7 mm, ovoid, many-seeded, dehiscing by 6 teeth. Seeds spinulose on the dorsal surface.

*Flowering and fruiting:* April to June.

*Distribution and habitat:* Northern Oman, in the mountains, in shaded and moist locations, amongst rocks and in rock crevices, often in cultivations by irrigation channels. *Altitude:* 1000–2000 m. Distributed in NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 121. *Illustration:* Plate 74.

*Notes:* *Silene* species in the northern mountains including Musandam, all fall under this species. Species previously identified as *S. flammulifolia* Stued. ex A. Rich. or *S. burchellii* DC. are now placed under this species (see also explanation in Miller & Cope 1996). I have not recognised *S. hochstetteri* Rohrb., since all Omani material can be identified to *S. schweinfurthii*.

## 17. *Gypsophila* L.

125 species, distributed in temperate Europe and Asia; 1 species in New Zealand and Australia.

- A. Leaves 10–15 × 4–6 mm, obovate to obovate-spatulate. Stems unbranched ..... 1. *G. bellidifolia*  
 A\*. Leaves 15–30 × 7–8 mm, lanceolate-obovate. Stems branched ..... 2. *G. montana*

1. *Gypsophila bellidifolia* Boiss., Diagn. ser. 1, 1 (1): 11 (1843); Fl. Or. 1: 553 (1867).

*Type:* [Oman], Mascate, *Aucher-Eloy* 4263 (syntypes G, G-Boiss, K, P.).

*Synonyms:* *Saponaria barbata* Barkoudah (1962).

*Description:* Delicate annual herb. Stems 7–10 mm, erect, single or 2, unbranched, glandular. Leaves few in number, forming a basal rosette, 10–15 × 4–6 mm, obovate to obovate-spatulate, somewhat fleshy, glandular-viscid; stipules absent. Flowers 1–2, in terminal cymes, pedicels up to 7 mm, filiform, glandular; calyx, 3–3.5 mm, campanulate, 5-toothed; petals 5, white or pale pink, free. Capsule elliptic, about as long as the calyx, dehiscent by 4 valves. Seeds ridged, grooved at the back.

*Flowering and fruiting:* February to March.

*Distribution and habitat:* Northern Oman, in the foothills of the mountains, in gravelly wadi beds and wadi fans, amongst stones. A shallowly rooted, short-lived annual, common after rain. *Altitude:* 30–650 m. Distributed in SW Pakistan (Baluchistan). Elsewhere in the Arabian Peninsula found in UAE.

*Distribution map:* Fig. 122. *Illustration:* Plates 75, 76.

*Notes:* A regional endemic distributed in SW Pakistan, northern Oman, and in the foothills of the mountains in UAE.

2. *Gypsophila montana* Balf. f., Proc. Roy. Soc. Edinb. 11: 501 (1882).

*Synonyms:* *Saponaria montana* (Balf. f.) Barkoudah (1962).

*Description:* Perennial herb with a woody base, sending stems annually. Stems up to 23 cm, profusely branched forming a cushion-shaped low herb, brittle, glandular and pubescent. Leaves basal, forming a rosette, absent from the flowering stems, 15–30 × 7–8 mm, lanceolate-obovate, apex acute, base tapering into a short petiole; stipules absent. Flowers in terminal branched cymes; pedicels 3–4 mm, densely glandular-hairy; calyx 3–5 mm, obconical, teeth > 1.5 mm, acute; petals white or pink, 3–5 mm, free, longer than the calyx. Capsule about



equalling the calyx, oblong, splitting by 4 valves. Seeds tuberculate, with a shallow groove at the back.

*Flowering and fruiting:* February to April; September.

*Distribution and habitat:* Southern Oman. Dhofar, in the foothills of the mountains, on open rocky slopes and gravel wadi beds. Fairly common after rain. *Altitude:* 100–1200 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen. Also found in Soqatra.

*Distribution map:* Fig. 123. *Illustration:* Plate 77.

*Notes:* This species has been recorded from northern Oman, but I have not collected this species from there. The record needs to be confirmed.

18. **Dianthus** L.

About 300 species, distributed from Eurasia to the African mountains.

- A. Calyx 11–15 mm. Bracteoles equalling or longer than the calyx. Petals dentate at the apex  
.....1. **D. cyri**
- A\* Calyx 30–35 mm. Bracteoles coming up to 1/3 the length of the calyx. Petals fimbriate  
up 1/2 the length. ....2. **D. crinitus**

1. *Dianthus cyri* Fisch. & Mey., Ind. Sem. Hort. Petrop. 4: 34 (1837).

*Description:* Annual herb. Stems 30–40 cm, branched, erect to ascending, sulcate, glabrous. Leaves opposite, 40–80 × 1.5–3 mm, linear, base sheathing, glandular-hairy on the margins; cauline leaves grading into bracts, stipules absent. Flowers in 1–3-flowered cymose clusters, peduncles up to 3 cm; bracteoles 4, 10–15 mm, equalling or longer than the calyx, lanceolate, green, cuspidate, calyx 11–15 mm, subcylindrical, narrowing above, teeth 5–7 mm, lanceolate, acute; petals 5, free, purple-pink, 15–20 mm, limb 4.5–5 mm, narrow ovate, dentate at the apex. Capsule ovoid, dehiscing by 4 teeth.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern Oman, in the Jebel Akhdhar range, in shaded, cultivated and moist locations, becoming weedy in irrigated and cultivated areas. *Altitude:* 650–1200 m. Distributed in SW Asia from E. Turkey to Afghanistan. Elsewhere in the Arabian Peninsula found on the mountains of the UAE.

*Distribution map:* Fig. 124. *Illustration:* Plate 78.

2. *Dianthus crinitus* Sm., Trans. Linn. Soc. London, Bot. 2: 300 (1794).

*Synonyms:* *Dianthus crinitus* var. *crossopetalus* Boiss. (1867).

*Vernacular names:* qerain al dhabi (eastern Hajar).

*Description:* Perennial herb. Stems 20–30 cm, with a somewhat woody rootstock, erect to ascending, unbranched, stems dying back completely during the dry season. Leaves up to 80 cm, linear, base sheathing on the swollen internodes, leaves reducing in size upwards; stipules absent. Flowers solitary or in few-flowered cymes; bracteoles 4–6, 12–18 mm, ovate cuspidate, coming up to 1/3 the length of the calyx, calyx 30–35 mm, narrow lanceolate, nervose; petals varied in colour from pale pink to dark pink, uniform or with a darker centre, claw 11–12 mm, fimbriate to about half its length. Capsule conical, dehiscing by 4 teeth.

*Flowering and fruiting:* November; June to August.

*Distribution and habitat:* Northern Oman, in the Hajar mountains, amongst stones and rocks, on open rocky places, in cracks on limestone boulders, under juniper trees, on accumulated soil amongst grass tufts of *Cymbopogon schoenanthus*. *Altitude:* 1200–3000 m. Distributed in SE Europe and SW Asia from Turkey to Afghanistan and C Asia. Elsewhere in the Arabian Peninsula found on the mountains of the UAE.

*Distribution map:* Fig. 125. *Illustration:* Plates 79–82.

*Notes:* The species is at its southernmost distribution in northern Oman and UAE. A variable species, which differs in the colour and degree of fimbriation of the petals, and size of calyx. Material from Oman does not show enough variations for any varieties to be recognized. The name of this species is based on material collected from Iran by Kotschy 21, 470 (K) and Aucher-Eloy 4233, 4237, 4244 (G-Boiss, K, P).

## 20. Polygonaceae

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### Key to the genera of Polygonaceae in Oman

- A. Herbs, annual or perennial up to 1 m
  - B. Flowers in terminal spikes or panicles. Perianth segments not spinescent
    - C. Perianth segments winged or toothed in fruit ..... 2. *Rumex*
    - C\*. Perianth segments neither winged nor toothed in fruit ..... 1. *Polygonum*
  - B\*. Flowers in axillary clusters. Perianth segments indurate, with 3 spines ..... 3. *Emex*
- A\*. Woody shrubs, up to 2 m
  - D. Leaves minute, soon falling, stems leafless for most of the year. Fruit 4-winged or wings obscure, covered with setae or wings toothed with straight teeth ..... 4. *Calligonum*
  - D\*. Leaves linear to terete, persistent. Fruit 3-winged, not covered with setae ..... 5. *Pteropryum*



1. **Polygonum L.**

About 150 species, cosmopolitan in distribution, especially in north temperate regions.

*Polygonum* s.l. and its related taxa are now often divided in several genera classified in two tribes Persicarieae and Polygoneae. These are separated on the characters of their filaments, nectaries, perianth nerves and ochrea: in *Polygonum* s.str., the ochrea are 2-lobed and lacerate at the top, and the inflorescence rarely very lax; in *Persicaria* the ochrea is cylindrical, truncate or ciliate at the top, and the inflorescence is congested and spike-like (see also Flora Nordica Vol. 1: 235–236). I have followed Thulin (*Flora of Somalia* 1: 176 (1993)) and retained the single Oman species under *Polygonum* s.l.

***Polygonum glabrum* Willd., Sp. Pl. 2(1): 447 (1799).**

**Synonyms:** *Persicaria glabra* (Willd.) M. Gomez (1896).

**Description:** Robust perennial herb, aquatic and rooting in mud. Stems erect, up to 60 cm, with horizontal stolons, glabrous reddish-green, covered with remains of brown leaf-sheaths. Ochrea up to 3 cm, truncate. Leaves up to 20 × 5 cm, lanceolate, apex acuminate, base cuneate, glabrous or sparsely white-pilose, ciliate, glandular-punctate. Flowers in dense terminal racemes, glabrous, perianth 3–4 mm, pink. Fruit (nut) ± 2 mm, trigonous, smooth, shining.

**Flowering and fruiting:** September to October.

**Distribution and habitat:** Southern Oman, in Dhofar, at the fringes of fresh water pools on the escarpment mountains and foothills. Not widespread but abundant where present. **Altitude:** 100–750 m. Distributed in Tropical Africa, Asia and America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

**Distribution map:** Fig. 126. **Illustration:** Plates 83, 84.

**Notes:** The species is common in a few wadis in Dhofar where there are permanent water pools, such as Wadi Darbar and Wadi Aythoom. There, the plants form a dense monospecific cover at the margins of shallow pools.

2. **Rumex L.**

200 species, distributed in the temperate regions of Europe and N America.

A. Inner fruiting perianth segments with conspicuous warts

W. Margin of the inner segments of fruiting perianth entire . . . . .1. **R. conglomeratus**

B\*. Margin of the inner segments of fruiting perianth toothed with straight teeth  
 . . . . .2. **R. dentatus**

A\*. Inner fruiting perianth segments with inconspicuous warts

C. Fruiting perianth segments broadly reniform (c. 3.5 × 6 mm) . . .3. **R. limoniastrum**

C\*. Fruiting perianth segments broadly ovate to orbicular (up to 11 mm)  
 . . . . .4. **R. vesicarius**

1. ***Rumex vesicarius* L., Sp. Pl. 336 (1753).**

**Vernacular names:** hamid.

**Description:** Annual herb, up to 30 cm. Stems branching from the base, ribbed, somewhat succulent, tinged red, glabrous. Leaves 12–41 × 6–45 mm, ovate-deltoid, apex acute to obtuse to rounded, base tapering into the petiole, margin entire, somewhat fleshy; petioles 6–35 mm. Flowers bisexual, in dense axillary racemes, solitary or paired. Inner 3 segments of the perianth broadly ovate to orbicular, with scarious wings, enlarging up to 11 mm in diameter in fruit,

greenish when young, yellow to pinkish-red with red veins when mature, convergent over the fruit; warts absent or small and inconspicuous.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Throughout Oman, common in wadi banks and wadi beds, on sandy, rocky and gravelly soils, and stony hill slopes. *Altitude*: 0–1800 m. Distributed from Egypt east to SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 127. *Illustration*: Plate 85.

*Notes*: A widespread species, a common annual which comes up after the rains. The slightly sour leaves are eaten as salad or cooked in soups.

**2. *Rumex limoniastrum*** Jaub. & Spach, *Illustr. Pl. Or.* 2: t. 106 (1844).

*Type*: Oman, *Aucher-Eloy* 5280 (syntypes BM, P).

*Description*: Monoecious or dioecious shrub, glabrous throughout. Stems erect or ascending. Leaves narrowly elliptic to oblanceolate, 33–50 × 10–50 mm, acute, entire, base attenuate, obscurely 3-nerved. Inflorescence paniculate. Flowers unisexual; inner segments of fruiting perianth broadly reniform, with scarious wings, 3.5 × 6 mm, entire, cordate at the base, ripening red or straw-coloured; warts minute, 0.5 × 0.3 mm.

*Flowering and fruiting*: March to April.

*Distribution and habitat*: Northern Oman, in the Jebel Akhdhar range of the northern mountains, occurring amongst stones and rocks. *Altitude*: ± 1800 m. Endemic to Oman.

*Distribution map*: Fig. 128.

*Notes*: Endemic to northern Oman. The species comes closest to *R. nervosus* Vahl, differing in its broadly reniform segments of the fruiting perianth. Described from the type collection and not collected since, possibly because of its overall resemblance to *R. vesicarius* and therefore not readily collected. More collections are necessary to confirm its taxonomic position and status in Oman.

**3. *Rumex conglomeratus*** Murr., *Prodr. Fl. Goett.* 52: (1770).

*Description*: Perennial herb. Stems erect, glabrous, up to 30 cm. Basal leaves 10–15 × 3–5 cm, oblong-lanceolate, apex acute or obtuse, base truncate or subcordate; petioles up to 15 cm. Flowers bisexual, in panicles of many racemose branches. Inner 3 segments of the perianth 2–3 × 1–2 mm, oblong-ovate, coriaceous, entire, reddish-brown when mature; each segment with a conspicuous wart.

*Flowering and fruiting*: ?April.

*Distribution and habitat*: Northern Oman, in the Hajar mountains, in disturbed habitats on moist ground. *Altitude*: ± 1900 m. Widespread in the temperate regions of the world. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 129.

*Notes*: The species has been recently introduced in Oman. It is known from a single locality on the Sayq plateau in the Jebel al Akhdhar range. There are only a few permanent pools on the



Sayq plateau, but in the last decade several dams have been constructed to collect water. This has encouraged the growth of several species especially those that are weedy.

4. *Rumex dentatus* L., Mant. pl. 2: 226 (1771).

*Description:* Annual herb. Stems erect, glabrous, up to 40 cm. Basal leaves 10–14 × 4–6 cm, oblong-lanceolate, apex acute or obtuse, base truncate; petioles up to 12 cm. Flowers in whorls in the nodes subtended by small foliaceous bracts; inner 3 segments of the perianth ± 4 mm, ovate-lanceolate, yellow-green when mature; margin of each segment toothed with straight teeth and conspicuous warts.

*Flowering and fruiting:* April?

*Distribution and habitat:* Northern Oman, on the Batmah coast, as a weed of agriculture. *Altitude:* ± 2000 m. Widespread in Europe and Asia as a weed of irrigated and cultivated ground. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 130.

3. *Emex* Campd.

2 species, distributed in the Mediterranean region, South Africa and Australia.

*Emex spinosa* (L.) Campd., Monogr. Rumex 58 (1819).

*Synonyms:* *Rumex spinosus* L. (1753).

*Vernacular names:* lisān al kalb.

*Description:* Monoecious annual herb. Stems decumbent to prostrate, weak, glabrous, 5–40 cm, with a thick white fleshy tap root. Leaves in a basal rosette, 22–70 × 12–50 mm, ovate to oblong, apex acute to obtuse or rounded, base tapering into the petiole, margin entire; petioles up to 70 mm. Flowers in axillary clusters; male flowers pedicellate, c. 1.5 mm; female flowers sessile, 5–6 mm; fruiting perianth 4–5 × 3–4 mm (including the spines), persistent and enclosing the fruit, the outer segments provided with 3 terminal divergent spines; spines 1–2 mm.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, including Musandam and the Batmah coast, on sandy or silty soils, and in cultivated fields and farmlands. *Altitude:* 10–200 m. Distributed from Egypt east to SW Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 131.

*Notes:* Common in Oman on the Batmah as a weed of agriculture and on disturbed and waste grounds.

4. *Calligonum* L.

80 species, distributed in the Mediterranean region and Arabia.

A. Fruit with 4 prominent wings

B. Wings covered with branched setae .....1. *C. comosum*

B\*. Wings toothed, setae absent .....3. *C. tetrapterum*

A\*. Fruit with obscure wings .....2. *C. crinitum*

1. *Calligonum comosum* L 'Herit., Trans. Linn. Soc. 1: 80 (1791).

*Synonyms*: *C. polygonoides* L., subsp. *comosum* (L. 'Herit) Soskov (1975).

*Vernacular names*: abal, abāl, arta, ḡakar; 'ibleh (Harsūsī).

*Description*: Shrub, 40–120 cm. Stems erect to ascending, older branches knotty and gnarled at the nodes, bark white-grey; young shoots green. Leaves minute, soon deciduous, branches leafless for most of the year. Flowers in axillary spikes; pedicels equal to or slightly longer than the perianth lobes; perianth-lobes  $\pm$  3 mm, oblong, white-pink with a green median stripe; stamens 18–19; ovary 4-angled, styles 4. Fruit (achene) 1–1.5 cm, red or pale-yellow, 4-winged, with short longitudinal wings covered with branched setae.

*Flowering and fruiting*: February–March.

*Distribution and habitat*: Northern Oman, in the eastern province, on sand and on sand dunes in the eastern and western sandy deserts, forming the dominant woody vegetation there.

*Altitude*: 10–200 m. Distributed in deserts from Egypt eastwards to Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 132. *Illustration*: Plates 86–88.

*Notes*: A characteristic plant of dune deserts, present where the sand is relatively deep. The long roots of the plant grow deep and also horizontally and obtain surface water from dew. An effective sand binder which harbours several psammophilous species underneath its branches. Populations with red or yellow fruits are present in the eastern sand desert, the Wahibah Sands, where the species is most abundant.

2. *Calligonum crinitum* Boiss., Diagn. Pl. Or. Nov. Ser. 2, 3 (4): 77 (1859)

subsp. *arabicum* (Soskov) Soskov, Novosti Sist. Vyssh. Rast. 12: 152 (1973).

*Synonyms*: *C. arabicum* Soskov (1973).

*Vernacular names*: abal, abāl, arta, ḡakar

*Description*: Shrub, up to 2 m. Stems erect to ascending; older branches knotty at the nodes, bark white-grey; young shoots green. Leaves small, soon deciduous, branches leafless for most of the year. Flowers 1–2, in axils of lateral branches; pedicels shorter than the perianth lobes; perianth-lobes  $\pm$  3 mm, oblong, white-pink with a green median stripe; stamens 18–19; ovary 4-angled, styles 4. Fruit (achene) 1–1.5 cm, red or yellow-white, wings obscure, covered with simple or branched setae.

*Flowering and fruiting*: February–March.

*Distribution and habitat*: Northern Oman, in the western sand desert, on deep sand at the UAE–Oman boundary. *Altitude*: 20–200 m. Endemic to the Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig 133. *Illustration*: Plate 89.

*Notes*: In Oman, not as common as *Calligonum comosum*. It occurs in the sandy desert on the eastern edge of the Rub al Khali in the south and the Oman–UAE border areas in the north. The name of this species is based on material collected from Arabia, UAE, by Godrai 34 (isotype K).



3. *Calligonum tetrapterum* Jaub. & Spach, Ill. Pl. Or. 5: t. 471 (1856).

*Vernacular names*: abal, abāl, arta, dakar.

*Description*: Shrub very similar to *C. capponum*, but fruit with the wings toothed and without the soft setae, red or yellow-white.

*Flowering and fruiting*: February-March?

*Distribution and habitat*: Northern Oman, recorded from the foothills of the western Hajar, in gravel and stony wadi-beds and shallow sand. Distributed in Turkey, Iraq, Iran to C. Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 134.

*Note*: Apparently rare in Oman, but perhaps mistaken for *Calligonum comosum* and overlooked. I have not seen any collections from Oman.

4. *Pteropyrum* Jaub. & Spach

5 species, distributed in SW Asia.

*Pteropyrum scoparium* Jaub. & Spach, Illustr. Pl. Or. 2: t. 109 (1844).

*Type*: [Oman], Mascate, *Ancher-Eloy* 5720 (BM, K).

*Vernacular names*: sidaf, sīdāf.

*Description*: Shrub, up to 1.5 m. Older stems twisted and gnarled, white-grey. Leaves alternate or in fascicles, 11–15 × 1–1.5 mm, linear to terete, apparently spirally arranged on the stems, glabrous. Flowers bisexual, in axillary clusters, perianth segments 5, 1.5–2 mm, white or cream tinged with pink, veins green; pedicels  $\pm$  5 mm; outer 2 segments reflexed in fruit, the inner 3 enclosing the fruit; stamens 8, anthers orange-red; styles 3. Fruit (nutlet), 4–8 mm including the wings, 3-lobed, 3-winged, wings membranous, reddish-brown when ripe.

*Flowering and fruiting*: March to April.

*Distribution and habitat*: Northern Oman, including Musandam and the Batinah, in the wadis and foothills of the northern mountains, in gravelly and sandy wadi beds. The species often forms large mono-specific stands. *Altitude*: 50–600 m. Endemic to Oman and UAE.

*Distribution map*: Fig. 135. *Illustration*: Plates 90, 91.

*Note*: A regional endemic whose centre of distribution is in northern Oman, but extends into the wadis of the hills in the UAE. Common in water courses of seasonally flowing wadis. Leaves are eaten with salt as salad. The species is very similar to *P. ancheri* from Iran, Afghanistan and Baluchistan and perhaps conspecific with it (see also Miller & Cope 1996).

## 21. Plumbaginaceae

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### Key to the genera of Plumbaginaceae in Oman

- A. Leaves broadly ovate to suborbicular, leaf-base clasping the stem. Leaves covered with a white mealy powder ..... 3. **Dycrophytum**
- A\*. Leaves not as above
  - B. Flowers pink to pale pink; calyx not covered with glandular hairs. Plants of saline soils (in Oman), often coastal ..... 2. **Limonium**
  - B\*. Flowers blue to pale-blue; calyx covered with glandular hairs. Plants not coastal or of saline soils ..... 1. **Plumbago**

#### 1. **Plumbago** L.

About 20 species, distributed in the tropical and warm temperate regions.

*Plumbago zeylanica* L., Sp. Pl. 151 (1753).

*Vernacular names:* elkīn, elsrīn, enqīn, enṣarun, herum dhezen, ketīl dhoṭin, qomsheli, ṣeteq, ṣefiqet, seṣ'onte (Jibbālī).

*Description:* Scrambling shrub, up to 2 m. Stems glabrous below, sessile glandular in the inflorescence region. Leaves alternate, 6–10 × 2–4 cm, ovate to ovate-elliptic, apex acute, base tapering into a short petiole, margins undulate. Flowers in terminal racemes, inflorescence axis with sessile glands, sticky. Bracts 4–5 mm, ovate, covered with sessile glands; calyx 12–14 mm, tubular, with 5 short lobes above, covered with stalked and sessile glands, sticky; corolla white to white suffused with blue, tubular, 24–25 mm, 5-lobed above, lobes spreading; corolla tube 20–23 mm; lobes 4–6 mm, obovate, often with an apiculate tip; stamens included in the corolla tube. Fruit 6–7 mm, cylindrical with a pointed apex, 1-seeded, enclosed in the persistent calyx.

*Flowering and fruiting:* September to November.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment mountains, in the *Anogeissus-Acacia* woodland, often occurring in moist locations and near water. *Altitude:* 200–450 m. Distributed in the tropical regions of Asia and Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 136. *Illustration:* Plate 92.

#### 2. **Limonium** Miller (nom. conserv.)

*Statice* sensu auct., non L.

About 350 species, cosmopolitan in distribution, especially on coasts and dry regions in the northern hemisphere.

#### A. Leaves forming a basal rosette

B. Leaves 5–10 × 1–5 cm. Panicles up to 30 cm; calyx glabrous ..... 1. **L. axillare**

B\*. Leaves 0.8–3.5 × 0.4–0.9 cm. Panicles up to 7 cm; calyx pilose on the nerves ..... 4. **L. milleri**



A\*. Leaves not forming a basal rosette

C. Calyx glabrous. Stems often covered with small wart-like tubercles . . . 3. *L. carnosum*

C\*. Calyx pubescent. Stems smooth

D. Leaves spatulate to obovate, 5–7 mm broad. Small subshrub, not branching profusely . . . . . 2. *L. stocksii*

D\*. Leaves linear spatulate, 1–3 mm broad. Shrub, branching profusely . . . . . 4. *L. sarcophyllum*

1. *Limonium axillare* (Forssk.) Kuntze, Rev. Gen. Pl. 2: 395 (1891).

*Synonyms*: *Statice axillaris* Forssk. (1775).

*Vernacular names*: qataf; ramṭ, shiṣyit, siṣyit, teḥameh (Jibbālī).

*Description*: Biennial shrub, up to 60 cm. Stems ascending to erect, the basal part covered with remains of old leaves. Leaves in basal rosettes, 5–10×1–5 cm, oblong-spatulate to obovate, apex obtuse to subacute, base tapering. Leaves green to grey-green, punctate with salt glands and covered with excreted salt. Flowers in large panicles up to 30 cm; flowers arranged in 2-flowered spikelets along the inflorescence; each spikelet subtended by 2 bracts; bracts  $\pm$  1 mm, ovate, pink-brown; the two flowers subtended by a bract  $\pm$  3 mm, margin scarious; inner flower subtended by another bract slightly shorter than the outer; calyx tubular, 3–4 mm, shallowly 5-lobed above, scarious with 5 red-brown veins, pubescent below; petals purple-pink, 5 mm, notched at the apex, fused below; stamens 5, exceeding the petals. Fruit  $\pm$  1 mm, ovoid, 1-seeded, enveloped by the persistent calyx.

*Flowering and fruiting*: September to October, but also flowering at other times.

*Distribution and habitat*: Southern Oman, Dhofar, occurring along the coast, at the edges of coastal marshes and in sandy and saline habitats, but never far inland. *Altitude*: Sea level. Distributed in Egypt (by the Red Sea coast), Pakistan and Ethiopia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen. Also found in Socotra.

*Distribution map*: Fig. 137. *Illustration*: Plate 93.

*Notes*: In Oman, the species does not extend beyond 21° N. Further north it is replaced by *Limonium sarcophyllum*. *L. axillare* is based on material collected from Yemen (al Luhayyah) by P. Forsskal, no. 552 (C).

2. *Limonium stocksii* (Boiss.) Kuntze, Rev. Gen. Pl. 2: 396 (1891).

*Type*: [Oman] Mascate, *Ancher-Eloy* 5243 (syntypes G, G-Boiss, K, P).

*Synonym*: *Statice orobanchum* Taub. & Spach (1844); type, same as above. *Statice stocksii* Boiss. in DC. (1848); Boiss. (1879).

*Vernacular names*: ejēsebeh, gēsib, gesob (Iḥarsūsī).

*Description*: Perennial subshrub, up to 30 cm. Stems erect to ascending, spreading, older branches twisted and gnarled and leafless. Basal part of stems covered with old leaf bases. Leaves alternate, sessile to subpetiolate, 5–12×5–7 mm, spatulate to obovate, apex obtuse, base tapering, leaves grey-green, covered with powdery salt. Flowers in small panicles of up to 3 cm; flowers arranged in 2-flowered spikelets along the inflorescence; each spikelet subtended by 2 bracts; outer bract  $\pm$  1 mm, ovate, pink-brown; bract subtending the two flowers c. 3 mm, glabrous, brown with a scarious margin; inner flower subtended by another bract slightly shorter than the outer; calyx infundibuliform, 1.5–2 mm, scarious, shallowly 5-lobed above, with 5 reddish-brown veins, pubescent; petals purple-pink, 5 mm, oblong, fused below,

stamens 5 exceeding the petals. Fruit  $\pm$  1 mm, ovoid, 1-seeded, enveloped by the persistent calyx.

*Flowering and fruiting*: November to April.

*Distribution and habitat*: Throughout central Oman, and the drier areas of Dhofar, and Halaniyah Island, on dry saline soils in the *Acacia tortilis*–*A. ehrenbergiana* scrubland. Also present on sandy coastal beaches associated with *Atriplex* and *Suaeda* species. *Altitude*: Sea level–30 m. Distributed in SW Pakistan (Baluchistan), Afghanistan, Iran. Elsewhere in the Arabian Peninsula found in UAE.

*Distribution map*: Fig. 138. *Illustration*: Plates 94–96.

*Notes*: This species is typically found on sabkhas (salt plains), at the edges of coastal salt marshes or inland on saline soils. Common on the Barr al Hikman peninsula, where it forms the major subshrub of the sabkha.

### 3. *Limonium sarcophyllum* Ghaz. & Edmondson, Edinb. J. Bot. (2003).

*Type*: Oman, Was Ras Shajar, c. 2 km from Bimah, coastal wadi, 7 Nov. 1993, S.A. Ghazanjar 2746 (holotype K).

*Description*: Robust perennial shrub, up to 60 cm. Stems glabrous, ascending to erect, branching from the base; basal part of stems covered with remains of leaf bases. Bark of older stems white-grey. Leaves alternate, arranged spirally, crowded, grey-green, sessile, somewhat fleshy, finely punctate and covered with crystals of excreted salt, without veins; lamina 15–30  $\times$  1–3 mm, linear-spatulate, apex obtuse, base cuneate, expanding at the base, sheathing, becoming hard and woody. Inflorescence of one-sided spicate panicles; panicles leafless, up to 5 cm; bracts subtending the inflorescence 1–1.5 mm, triangular, glabrous; peduncles and inflorescence axes glabrous, grey-green; flowers pale pink to pink, 4–5 mm, arranged in 2 flowered spikelets, one flowering before the other; bract subtending the spikelet  $\pm$  1 mm, broadly ovate, obtuse, brown, glabrous; outer bract subtending the flowers 3–3.5 mm, keeled at the back, brown with a white scarious margin, glabrous; inner bract smaller, c. 2.5 mm, ovate, pale brown, glabrous; calyx 3–3.5 mm, pinkish-red, infundibuliform, 5-lobed above; lobes 0.5 mm, rounded at the apex with white-margins, 5-nerved, white-pilose on the nerves; petals oblong, a third longer than the sepals; stamens equalling the corolla or slightly exerted from it. Fruit 1-seeded, glabrous, enveloped by the persistent calyx.

*Flowering and fruiting*: More or less throughout the year.

*Distribution and habitat*: Endemic to Northern Oman, occurring on the coastal strip of the eastern Hajar mountains, common between Dibab and Ras al Hadd where it forms the dominant coastal shrub. It grows above the high tidemark, in pockets of sand and soil and amongst rocks and stones, with *Suaeda acqytiana* and other coastal vegetation. It also occurs at the mouths of coastal wadis, on gravel and sand with *Acacia tortilis* and *Ziziphus spina-christi*. The species does not extend south beyond the sandy expanse of the Wahibah Sands. *Altitude*: Sea level–10 m.

*Distribution map*: Fig. 139. *Illustration*: Plates 97, 98.



4. *Limonium milleri* Ghaz. & Edmondson, Edinb. J. Bot. (2003).

*Type*: Oman, Dhofar, Salalah to Thamrait, low hills with *Euphorbia balsamifera* and low grassland, 8 Nov. 1985, A.G. Miller 7530 (holotype E, isotype K).

*Description*: Low, woody-based perennial herb, 6–15 cm, forming clumps. Stems glabrous, ascending to erect, sparsely branching from the base, covered with remains of old leaf bases. Leaves alternate, grey-green, all radical, absent above, arranged spirally and crowded on the stems, sessile, without midrib or lateral veins, lamina 8–35 × 4–9 mm, spatulate, apex rounded, often with a small apical spicule, base cuneate, expanding at the end and sheathing the stem, becoming hard and woody after leaves fall off. Inflorescence axis divaricate, up to 7 cm, with flowers in one-sided spicate panicles; panicles leafless, 3–7 cm; bracts subtending the inflorescence 1.5–2.0 mm, triangular, glabrous; peduncles and inflorescence axes glabrous; bract subtending the spikelet 1–1.5 mm, broadly ovate, obtuse, brown, glabrous; outer bract subtending the flowers 3–3.5 mm, suborbicular, brown with a broad white scarious margin, pubescent or glabrous; inner bract 2.0 mm, narrow ovate, pale brown, glabrous, scarious towards the apex; calyx 3.5–4 mm, pink, infundibuliform, 5-lobed above; lobes c. 0.5 mm, rounded at the apex with white margins, 5-nerved, nerves red, with long white hairs on the nerves and base of calyx; petals white, oblong, slightly longer than the sepals, falling soon; stamens equalling the corolla or slightly exerted from it. Fruit 1-seeded, glabrous, enveloped by the persistent calyx.

*Flowering and fruiting*: September.

*Distribution and habitat*: Endemic to Dhofar, occurring on exposed hills and low grassland, in the *Euphorbia balsamifera* zone. *Altitude*: 600–800 m.

*Distribution map*: Fig. 140. *Illustration*: Plates 99, 100.

*Notes*: A collection from the drier north-facing slopes of Dhofar by Sheila Collenette (Plate 101), is a robust plant with broader leaves and congested inflorescences which could be this species, but I have not seen the actual collection.

**Species doubtfully recorded from Oman**

*Limonium carnosum* (Boiss.) O. Kuntze, Rev. Gen. Pl. 2: 395 (1891).

*Synonyms*: *Statice carnosum* Boiss. (1879).

*Description*: Perennial shrub. Stems glabrous, branching from the base, ascending to erect, rigid and somewhat zig-zag, foveolate (covered with wart-like tubercles); basal part of stems covered with remains of old leaf bases. Leaves grey-green, 15–30 × 1–3 mm, linear-spatulate, apex obtuse, base long cuneate. Flowers pink or purple-pink, in short spicate panicles. Flowers 4–5 mm, arranged in 2-flowered spikelets; calyx 2.5–3 mm, pink-red, infundibuliform, shallowly 5-lobed above, glabrous; petals pale-pink, 4.5–5 mm, oblong; stamens equalling the corolla or slightly exerted from it. Fruit 1-seeded, enveloped by the persistent calyx.

*Flowering and fruiting*: ?April.

*Distribution and habitat*: Northern Oman, found on sand and gravel in desert wadis, and on sandy hummocks between the Oman–UAE border. *Altitude*: ± 50 m. Distributed in NW Iran, Iraq, Jordan, Syria, Armenia and Transcaucasia (in the latter two regions it is a montane species occurring from 1000–1500 m, Rech. f., op. cit.). Elsewhere in the Arabian Peninsula recorded from Kuwait, Saudi Arabia, UAE.

*Distribution map*: Fig. 141.

*Notes:* This taxon is not common and has only been collected once in Oman from the north western desert areas. It is reported from UAE (M. Jongbloed et al. 2000; J. Edmondson pers. comm.). The material present at Kew from Oman is very poor with only a single collection that is damaged and does not show the stems or flowers adequately.

The photograph in Collenette 1999: p. 605 is possibly that of *L. carnosum* L. showing the foveolate stems found in that species. The name *L. carnosum* is based on material collected from Iran (Khoi) by Aucher-Eloy 2505 (K, G). In addition to this species *L. pruinatum* (L.) Chaz. may occur in Oman. This is a robust plant with foveolate stems, flowers about 3 mm, glabrous calyx and each lobe with a distinct brown-red medial nerve.

### 3. **Dyerophytum** Kuntze

3 species, distributed in S Africa, India, Arabia and Soqatra.

*Dyerophytum indicum* (Gibbs. ex Wight) Kuntze, Rev. Gen. Pl. 2: 394 (1891).

*Type:* [Oman], Mascate, Aucher-Eloy 5258 (syntypes G-Boiss., P);

*Synonyms:* *Vogelia arabica* Boiss. in DC. (1824); *Vogelia indica* Wight (1847);

*Vernacular names:* mellah, melheloh; emloh (Jibbālī),

*Description:* Shrub, up to 2 m, glaucous. Leaves and stems covered with a white mealy powder. Leaves alternate, grey-green, 1–8 × 2–8 cm, broadly ovate to suborbicular, apex rounded with an apiculate tip, leaf-base clasping the stem, margins undulate. Flowers in terminal spikes, calyx 7–10 mm, purple suffused with yellow, 5-lobed, lobes free almost to the base, margins of lobes membranous and appearing winged; corolla tubular, yellow-orange, with purple-red mid vein and margins, exserted from the sepals, 5-lobed at the apex; corolla tube 15–20 mm, lobes 3–4 mm; stamens 5. Fruit 7–9 mm, enclosed in the calyx and dispersed with it.

*Flowering and fruiting:* March to April; September to October.

*Distribution and habitat:* Throughout Oman, in the foothills of the northern mountains, in stony wadis, and drier areas of Dhofar. *Altitude:* 150–500 m. Distributed in Western India. Elsewhere in the Arabian Peninsula found in Yemen. Also found in Soqatra.

*Distribution map:* Fig. 142. *Illustration:* Plates 102–104.

## 22. Tiliaceae

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## Key to the genera of Tiliaceae in Oman

- A. Fruit cylindrical, beaked at the apex . . . . . 2. **Corchorus**  
 A\*. Fruit neither cylindrical nor beaked at apex  
 B. ~~Herbaceous perennials or annuals. Fruit subglobose, provided with soft spines, never~~  
 lobed. . . . . 3. **Triumfetta**  
 B\*. Woody shrubs and trees. Fruit globose, 2–4-lobed, glabrous or pubescent, but never  
 spiny. . . . . 1. **Grewia**

1. **Grewia** L.

About 150 species, distributed in the warm regions of the Old World.

- A. Flowers dull-yellow to orange-brown  
 B. Leaves obovate to orbicular. Fruit 2–4-lobed, densely hairy . . . . . 4. **G. villosa**  
 B\*. Leaves lanceolate to ovate-obovate. Fruit 2-lobed, glabrous . . . . . 1. **G. damine**  
 A\*. Flowers white  
 C. Leaves elliptic to obovate. Fruit 2- or 4-lobed, black when ripe . . . . 3. **G. erythraea**  
 C\*. Leaves broadly obovate to sub-orbicular. Fruit 2–4-lobed, orange-yellow when ripe  
 . . . . . 2. **G. tenax**

1. **Grewia damine** Gaertn., *Fruct. Sem. Pl.* 2: 113, t. 106 (1791).

*Synonyms*: *Grewia bicolor* Juss. (1804).

*Vernacular names*: gared, ghared; akimbor (fruit) (Jibbālī).

*Description*: Shrub or small tree, 2–4 m, stellate-hairy. Bark grey. Leaves alternate, stipulate, 1–5 × 0.6–2 cm, lanceolate to ovate-obovate, apex subacute, base cuneate to truncate, margin crenate to dentate; leaves 3-veined at the base, green above, grey beneath. Flowers in 2–3-flowered axillary cymes; pedicel 2–3 mm, pubescent; sepals 12–13 mm, dull yellow-green, linear-oblong; petals dull yellow, ± 6 mm, oblong, shortly clawed, notched at the apex, a white pubescent nectariferous gland present at the point of insertion; stamens many, in 2 whorls; ovary densely pubescent. Drupe 6–8 mm, 2-lobed, glabrous.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, in the escarpment mountains, in the monsoon-affected areas or in the drier areas near permanent water holes. *Altitude*: 400–500 m. Distributed in tropical Africa, Iran, Pakistan, India and Nepal. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 143. *Illustration*: Plate 105.

*Notes*: The fruits are edible. The leaves have been used traditionally as washing soap in Dhofar.

2. **Grewia erythraea** Schweinf., *Verh. Zool.-Bot. Ges. Wein* 18: 671 (1868).

*Synonyms*: *Grewia tenax* (Forssk.) Fiori var. *erythraea* (Schweinf.) Chiov. (1929); *G. tenax* subsp. *makaranika* (Rech. f & Esfand.) Browicz (1981).

*Vernacular names*: sharḥam, sherḥam; zkhanitte (Jibbālī).

*Description*: Shrub, 1–2 m, stellate-hairy. Stems and branches stunted, often straggling or growing prostrate. Bark grey. Leaves alternate, in fascicles, stipulate, 1–2 × 0.4–0.7 mm, elliptic to obovate, apex obtuse, base cuneate, margin serrate; leaves 3-veined at the base, green on both

surfaces; petiole 2–3 mm. Flowers 1–2, axillary, fragrant; pedicel 3–4 mm; sepals 9–10 mm, linear-oblong, stellate-hairy; petals white,  $\pm$  6 mm, linear-oblong, shortly clawed, notched at the apex, a white-pubescent nectariferous gland present at the point of insertion; stamens many, in 2 whorls; ovary 1–4-lobed, densely hairy. Drupes 5–8 mm, globose, 2–4-lobed (sometimes 3-lobed by poor development or abortion), with scattered long hairs, red eventually turning black.

*Flowering and fruiting*: March to June.

*Distribution and habitat*: Northern Oman and Dhofar, common on the foothills of the northern mountains, in gravel wadi beds, in the *Acacia tortilis*–*Euphorbia larica* shrubland. In Dhofar it is found on the dry, high plateau. *Altitude*: 50–1850 m. Distributed from NE Africa to Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 144. *Illustration*: Plate 106.

*Notes*: A species variable in the size of its flowers and leaves. The fruits are sweet and edible. The foliage is browsed by goats, cattle and camels. Plants with cuneate-obovate leaves and short petioles and pedicels (as found in our plants) have been treated as *G. tenax* subsp. *makranika* (Rech. f. & Esfand.) Browicz, endemic to Baluchistan. This species is one of several species originally collected from Baluchistan (SW Pakistan) and considered to be endemic there, but are now also known to occur in the mountains and foothills of the northern mountains of Oman. *G. erythraea* is based on material collected from Saudi Arabia, Ehrenberg s.n. (syntype B, destroyed), Sudan, Schweinfurth 2490 (isotype BM), Schweinfurth 2488 & 2491.

**3. *Grewia tenax*** (Forssk.) Fiori, Agric. Colon. 5, Suppl.: 23 (1912).

*Synonyms*: *Chadara tenax* Forssk. (1775); *Grewia populifolia* Vahl (1790).

*Vernacular names*: ḥarsūt, ḥershāmeḥ (Jibbālī).

*Description*: Straggling shrub, up to 3 m, stellate-hairy. Bark grey. Leaves alternate, glabrous, stipulate, 1–4 × 0.5–3.5 mm, broadly obovate to suborbicular, apex obtuse, base cuneate, margin crenate to dentate, 3–5-veined at the base, green on both surfaces. Flowers solitary, in the axils of leaves; pedicel  $\pm$  3 mm; sepals greenish-white,  $\pm$  13 mm, linear-oblong, stellate-hairy, petals white, 10–12 mm, oblong, shortly clawed, notched at the apex; stamens many, in 2 whorls; ovary 4-lobed, glabrous. Drupes 5–8 mm, 2–4-lobed, glabrous, orange-yellow when ripe.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, in the drier areas, in gullies and dry channels, amongst rocks and stones. *Altitude*: 50–350 m. Distributed in tropical and north Africa to SW Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 145.

*Notes*: This and the previous species, *G. erythraea*, are similar in facies and have been treated conspecific by some authorities (see K. Browicz in *Flora Iranica*). Both have white flowers which are similar in size, but whereas *G. erythraea* has ovate-obovate leaves and a pubescent ovary, *G. tenax* has broadly obovate to suborbicular leaves that are not markedly serrate or dentate and a glabrous ovary. In Oman, *G. tenax* is not found in the north. *G. tenax* is based on material collected from Yemen, Taizz, by Forsskal (syntypes C, B).



4. *Grewia villosa* Willd., Nov. Act. Cur. Berol. 205 (1803).

Vernacular names: klinitē; khi, khoṭ (Jibbālī).

Description: Shrub or a small tree, 2–3 m, stellate hairy, glabrous with age. Bark grey. Leaves alternate, grey-green, densely pubescent, stipulate, 1–2 × 0.5–1.3 cm, obovate to orbicular, margin crenate to dentate, apex acute to subacute, base somewhat cordate, 3-nerved at the base. Flowers in 2–4 flowered cymes, axillary, orange-brown; pedicels ± 4 mm, pubescent; sepals 8–10 mm, linear-oblong, green on the outer surface, pale brown on the inner surface, hairy on the outer surface, petals ± 5 mm, oblong, shortly clawed, notched at the apex, provided with a hairy gland at the base; stamens many, in 2 whorls; ovary 1–2-lobed, densely hairy, stigma lacinate at the top. Drupes 10–15 mm, globose, 2–4-lobed, densely villous, orange-red when ripe.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman and Dhofar, in the foothills and in wadis. In northern Oman found in the Jebel Akhdar range at ± 1800 m. Altitude: 50–1800 m. Distributed from tropical Africa to Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map: Fig. 146.

Notes: The fruit is edible.

2. *Corchorus* L.

About 40 species, widely distributed in the tropical and subtropical regions.

- A. Prostrate woody herbs. Leaves with dentate margins . . . . .1. *C. depressus*
- A\*. Erect, herbaceous or woody herbs. Leaves with serrate margins
- B. Capsule 3-winged, 3-locular, dehiscing by 3 valves
- C. Basal appendages of leaves linear-filiform. Apical beak of capsule 2-fid . . . . .4. *C. aestuans*
- C\*. Basal appendages of leaves absent. Apical beak of capsule not 2-fid . . . . .3. *C. trilocularis*
- B\*. Capsule 10-angled, 5-locular, dehiscing by 5 valves . . . . .2. *C. olitorius*

1. *Corchorus depressus* (L.) Stocks, Proc. Linn. Soc. 1: 367 (1848).

Synonyms: *Corchorus antichorus* L. (1767); Boiss. (1867); *C. prostratus* Royle (1834).

Vernacular names: shalīmat ad dāb; ṣalunṭah (Ḥarsūsī).

Description: Annual or perennial herb with a woody base and many prostrate woody branches. Leaves alternate, subsessile, 5–15 × 4–4.5 mm, ovate to ovate-oblong, margins dentate, apex acute to subacute, basal appendages absent. Flowers small, ± 5 mm across, yellow, axillary; sepals 5, falling soon, petals 5, free, stamens many. Capsule 10–15 mm, cylindrical, 4-locular, apical beak not 2-fid; capsule dehiscing by 4 valves.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Throughout Oman. Common on gravelly and sandy places, in the foothills of the northern and southern mountains and in desert areas. Altitude: 20–1000 m. Distributed from Egypt to Iran, India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map: Fig. 147. Illustration: Plate 107.

*Notes:* The plant is abundant after rain and is grazed by all livestock.

**2. *Corchorus olitorius* L., Sp. Pl. 529 (1753).**

*Description:* Robust annual herb, with a woody base. Stems erect, 40–100 cm, glabrescent or glabrous. Leaves petiolate, alternate, 4–10 × 1–4 cm, lanceolate-elliptic, margin serrate, apex acute, basal appendages of leaves narrow-linear. Flowers yellow, about 8 mm across, axillary; sepals 5, falling soon; petals 5, free; stamens many. Capsule 5–10 cm, cylindrical, 10 angled, 5-locular, dehiscing by 5 valves.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, as a weed in cultivated areas. *Altitude:* 20–150 m. Native to India and Pakistan, now naturalized throughout the tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 148. *Illustration:* Plate 108.

*Notes:* Often cultivated.

**3. *Corchorus trilocularis* L., Syst. Nat. ed. 12, 2: 369 (1767).**

*Description:* Annual or perennial herb, herbaceous or with a woody base. Stems erect, 20–50 cm, glabrescent. Leaves petiolate, alternate, 1–4 × 0.6–2 cm, ovate to ovate-oblong, margin serrate, basal appendages absent. Flowers yellow, about 6 mm across, axillary; sepals 5, falling soon; petals 5, free; stamens many. Capsule 2–4 cm, cylindrical, 3-locular, 3-winged, apical beak not 2-fid; capsule dehiscing by 3 valves.

*Flowering and fruiting:* January to March.

*Distribution and habitat:* Northern Oman and Dhofar, in gravel wadis, irrigated and cultivated places. *Altitude:* 10–300 m. Distributed in the tropics of the Old World and in tropical Australia and America. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 149.

*Notes:* The leaves are soaked in water and the water is used as a shampoo and hair tonic. Sometimes cultivated as a vegetable.

**4. *Corchorus aestuans* L., Syst. Veg. ed.10: 1079 (1759).**

*Description:* Annual herb. Stems erect, 30–80 cm, glabrescent. Leaves petiolate, alternate, 2–7 × 1.5–4 cm, elliptic to ovate, margin serrate, apex acute, basal appendages of leaves linear-filiform. Flowers yellow, axillary; sepals 5, falling soon; petals 5, free; stamens many. Capsule 2.5–3 cm, cylindrical, 3-locular, 3-winged, apical beak 2-fid; capsule dehiscing by 3 valves.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, on the hills and plains, in the *Anogeissus-Delonix* woodland, where it is usually found on moist and shaded places such as on banks of permanent water bodies and amongst dense undergrowth. *Altitude:* 20–200 m. Widely distributed in tropical Africa. In Arabia found only in southern Oman.

*Distribution map:* Fig. 150.



3. **Triumfetta L.**

About 70 species, distributed in tropical regions.

*Triumfetta pentandra* A. Rich. ex Guill., Fl. Senegamb. Tent. 1: 93, t. 19 (1831).

*Description:* Annual herb. Stems erect, 25–60 cm, stellate-hairy. Leaves alternate, petiolate, 1.5–7 × 0.6–7 cm, broadly elliptic to ovate broadly ovate to rhomboid, with 3 obscure lobes, margin serrate to dentate, sparsely hairy, 3–5 veined. Flowers axillary, yellow; sepals ± 2 mm, ovate; petals as long as the sepals, spatulate; stamens 5–10. Capsule ovoid, 5–7 mm, 2-locular, densely tomentose, provided with ascending, uncinat spines.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment hills and drier areas of the mountains, often found growing near water. *Altitude:* 200–900 m. Distributed in tropical Africa, Pakistan to China. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 151. *Illustration:* Plate 109.

*Notes:* The species is variable in its leaf shape. The upper younger leaves tend to be smaller in dimensions, subsessile or with small petioles and elliptic to ovate in shape, while the older lower leaves are with long petioles and are rhomboid in shape. Some plants only show ovate to elliptic leaves.

*Triumfetta* sp. A

*Description:* Slender annual herb. Flowers axillary, pale yellow to reddish, 3 mm wide; petals narrower than in *T. pentandra*. Capsule ovoid, c. 1 cm long, larger than that in *T. pentandra*, densely white-woolly.

*Flowering and fruiting:* September/October.

*Distribution and habitat:* Southern Oman, Dhofar, in open light woodland and grassland areas in the upper altitudes of the escarpment mountains. *Altitude:* ± 700 m. Endemic to Dhofar.

*Distribution map:* Fig. 151. *Illustration:* Plate 110.

23. **Sterculiaceae**

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## Key to the genera of Sterculiaceae in Oman

- A. Epicalyx with 3 segments, often enlarging in fruit and enveloping it . . . . 1. **Melhania**
- A\*. Epicalyx not as above
  - B. Small herbs. Petals present. Fruiting carpels not spreading
    - C. Leaves irregularly lobed. Flowers about 2 cm across, in corymbose clusters, red . . . . 3. **Glossostemon**
    - C\*. Leaves obscurely or irregularly dentate. Flowers solitary or in racemes, yellow or red (if red then less than 2 cm across and solitary) . . . . 2. **Hermannia**
  - B\*. Trees. Petals absent. Fruiting carpels spreading . . . . 4. **Sterculia**

1. **Melhania** Forssk. (nom. conserv.)*Brotera* Cav.

60 species, distributed in the Old World tropics.

- A. Epicalyx not enlarging in fruit. Leaves broadly ovate to sub-orbicular . . . . 1. **M. ovata**
- A\*. Epicalyx enlarging in fruit. Leaves ovate or oblong
  - B. Leaves oblong . . . . 2. **M. muricata**
  - B\*. Leaves ovate . . . . 3. **M. phillipsiae**

1. **Melhania ovata** (Cav.) Spreng., Syst. Veg. ed. 16, 3: 32 (1822).var. *abyssinica* (A. Rich.) Schum., Monogr. afrikan. Pflanzenf. 5 (1900).Synonyms: *Brotera ovata* Cav. (1789); *Melhania abyssinica* A. Rich. (1847-53).

*Description:* Subshrub, up to 30 cm. Branches grey, spreading to form a cushion-shaped shrub. Leaves often plicate, 10–20 × 0.8–1.8 mm, broadly ovate to sub-orbicular, apex obtuse, base somewhat cordate to rounded, margin dentate, densely pubescent, grey-green. Flowers solitary in the axils of leaves, yellow; epicalyx (bracts) not enlarging in fruit; calyx campanulate, lobes ± 1 mm, acute; petals about as long as the calyx. Capsule 5-lobed.

*Flowering and fruiting:* May to July; September.

*Distribution and habitat:* Northern Oman, on the Hajar mountains, on rocky slopes, growing amongst rocks and stones and in rock crevices. *Altitude:* 1700–1900 m. Distributed in NE Africa (Somalia, Ethiopia) to Baluchistan (SW Pakistan). Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 152. *Illustration:* Plate 111.2. **Melhania muricata** Balf. f., Proc. Roy. Soc. Edinb. 11: 503 (1882).

*Description:* Prostrate to erect woody herb, up to 15 cm. Branches grey-green, stellate-pubescent. Leaves plicate, 15–20 × 5–6 mm, oblong, apex obtuse, base rounded, margin irregularly dentate, grey-green. Epicalyx (bracts) membranous, 1 × 2 cm, ovate cordate, orange to orange-red, enlarging and enclosing the flower and fruit. Flowers 2–4, axillary; sepals 4–5 mm, densely pubescent; petals green-yellow.

*Flowering and fruiting:* May to July.

*Distribution and habitat:* Northern Oman and southern Oman (Dhofar), in the foothills of the mountains and on rocky and stony wadi beds, and on hill slopes amongst rocks and stones.



*Altitude:* 50–550 m. Distributed in Somalia and Ethiopia. In the Arabian Peninsula found only in Oman. Also found in Soqatra from where it was originally described.

*Distribution map:* Fig. 153. *Illustration:* Plate 112.

### 3. *Melbania phillipsiae* Bak. f., Journ. Bot. 4 (1898).

*Description:* Shrub, up to 1.5 m. Stems and leaves with dense downy stellate-pubescent. Leaves alternate, 6–10 × 4–8 cm, ovate, apex acute, base cordate, margin denticulate. Flowers about 15 mm across, in 1–3 flowered cymes, axillary, pale yellow. Epicalyx (bracts)  $\pm 3 \times 2.5$  cm, orbicular-ovate, yellow-red to red gold, persistent, enlarging and surrounding the fruit; sepals united at the base, lobes acute; petals yellow.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern and Southern Oman; in northern Oman found in wadis and in Dhofar in the drier areas of the escarpment mountains. *Altitude:*  $\pm 300$  m. Distributed in N and NE Africa (NE Kenya, Somalia, S Egypt, Niger, Chad). Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 154. *Illustration:* Plate 113.

*Note:* An uncommon plant in the north, so far recorded from Wadi Mua'adin in the western Hajar mountains where it forms monospecific stands on the banks of a seasonal wide water channel.

## 2. *Hermannia* L.

About 100 species, distributed in the tropical and warm regions, especially South Africa.

- A. Perennial subshrub. Stems stellate-hairy, without glandular hairs. Flowers yellow . . . . . 1. *H. paniculata*  
 A\*. Annual herb. Stems with glandular and simple hairs. Flowers red . . . . . 2. *H. testacea*

### 1. *Hermannia paniculata* Franch., Sert. Somal. 19 (1882).

*Vernacular names:* kharjerit, kheruqret (Jibbālī).

*Description:* Subshrub, up to 25 cm, with a woody base, branches stellate-hairy to glabrescent. Leaves alternate, grey-green, 10–22 × 5–15 mm, broadly ovate, apex rounded, base rounded, margin irregularly dentate, stellate-hairy, nerves depressed, petiole 5–12 mm. Flowers in terminal racemes, yellow, becoming orange-red with age, nodding, pedicels slender; calyx 2.5–3 mm, campandate, lobes acute, pubescent; petals oblong, as long as the calyx; anthers cohering around the style. Fruit a capsule,  $\pm 4$  mm in diameter, 5-lobed, hairy, surrounded by the persistent calyx.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, occurring in the drier areas and coastal plains. *Altitude:* 50–120 m. Distributed in Somalia and Ethiopia. Also found in the drier plateau in the Mahra in eastern Yemen.

*Distribution map:* Fig. 155. *Illustration:* Plate 114.

2. *Hermannia testacea* Vollesen, Kew Bull. 40(3): 643–645 (1985).

*Description:* Delicate annual herb, 6–10 cm, with few branches, pubescent with simple and glandular hairs. Leaves with small petioles, lamina 5–7 × 3 mm, ovate to narrow ovate, margins obscurely dentate, lamina sparsely stellate-pubescent. Flowers red, solitary, axillary, with filiform pedicels, nodding; a fringe of hairs present at the articulation of pedicel and peduncle; sepals 5, united below to form a cup-like structure, lobes ± 1 mm, sparsely pubescent; petals obovate, about as long as the sepals. Capsule 3–5 mm, subglobose, sparsely hairy with glandular and simple hairs.

*Flowering and fruiting:* September, after the monsoons.

*Distribution and habitat:* Southern Oman, Dhofar, on the summit plateau, in grasslands and on low hills with *Euphorbia balsamifera*. *Altitude:* 700–800 m. Distributed in Ethiopia, from where it has been originally described.

*Distribution map:* Fig. 156. *Illustration:* Plate 115.

*Notes:* An ephemeral plant that comes up after the monsoons on the summit grasslands, with several other species of annuals. Over-grazing by camels and cattle, and road building has decreased the species richness on the summit grasslands. *H. testacea* is not common, at least not as common as some of the other unpalatable and weedy annual species that come to bloom after monsoons.

3. *Glossostemon* Desf.

A single species, distributed in Iran, Iraq and Arabia.

*Glossostemon bruguieri* Desf., Mem. Mus. Hist. Nat. Paris 3: 239, t. 11 (1817); Townsend, Fl. Iraq 4: 222 (1980).

*Description:* Robust perennial herb, up to 60 cm. Stems grey-green, stellate-hairy. Leaves alternate, petiolate, petiole stout, up to 10 cm, stellate-hairy; leaves, grey-green, 10–20 × 11–25 cm, sub-orbicular to orbicular, margin shallowly and irregularly lobed into 3–5 main and several smaller lobes, palmately 5–7-nerved, densely stellate-hairy on both surfaces. Flowers bright red, about 2 cm across, in corymbose clusters; calyx united basally, lobes acute, pubescent; petals longer than the calyx, ovate, lobed at the apex. Fruit (follicle) ± 5 cm, covered with long soft spines.

*Flowering and fruiting:* September, ?October.

*Distribution and habitat:* Southern Oman, Dhofar, in drier localities. *Altitude:* ± 50 m. Distributed in Iraq. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 157.

*Notes:* An uncommon species, but distinct in its red flowers which emit an unpleasant smell. The name of this species is based on material collected from Iraq, Baghdad by Olivier and Bruguere (P).

4. *Sterculia* L.

About 300 species, distributed throughout the tropics.



***Sterculia africana*** (Lour.) Fiori, Agric. Colon., Ital. 5 suppl. 37 (1912).  
*Synonyms:* *Callhama* Fussk. (1775) [species without epithet, see note in Hepper and Friis, 1994]; *Triplasia africana* Lour. (1790); *Callhama indiensis* J.E. Gmel. (1791); *Sterculia arabica* T. Anders. (1860).  
*Vernacular names:* ekthōreh, ekṭōreh (Jibbālī).

*Description:* Monoecious. Deciduous tree, up to 8 m with a rounded crown. Bark smooth, grey-brown. Leaves alternate, 8–15 cm long and broad, orbicular-ovate, often 3–5-lobed, apex obtuse, base cordate; petiole 5–10 cm, reddish, pubescent. Flowers showy, ± 2 cm across, in axillary panicles, appearing before the leaves; calyx yellow with red streaks, campanulate, 5-lobed above, lobes 6.5–7 mm, densely tomentose on the outer surface; petals absent. Fruit of 3–5 follicles, each 6 × 2 cm, red, becoming woody with age, densely stellate-pubescent with yellowish hairs; hairs inside the follicle urticating.

*Flowering and fruiting:* July to August.

*Distribution and habitat:* Southern Oman, Dhofar, on the seaward facing slopes of the escarpment mountains in the *Acacia-Commiphora* shrubland. *Altitude:* 500–800 m. Distributed in the Old World Tropics. Elsewhere in the Arabian Peninsula found in Yemen.

*Distribution map:* Fig. 158.

*Notes:* In Dhofar, the leaves appear at the start of the monsoon season in June/July and the flowers come out in August. The bark flakes off in irregular patches. The resin which oozes out of the bark has been used traditionally as washing soap and as a disinfectant.

24. Bombacaceae

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***Adansonia* L.**

8 species, distributed in east and west Africa, Madagascar, NW Australia, and introduced into India.

***Adansonia digitata* L., Sp. Pl. 1190 (1753).**

*Vernacular names:* enkhije, enkhize (Jibbālī). *Common name:* baobab.

*Description:* Large tree, 20–30 m. Trunk conical, tapering into thick branches, bark smooth, grey-black. Leaves alternate, simple or digitate, 1–7-foliolate; petiole up to 15 cm; leaflets sessile, glabrous, 5–15 × 2–7 cm, lanceolate, apex acute, base cuneate, margin entire. Flowers solitary or paired in the axils of leaves, pendulous, white; calyx 3–5-lobed, lobes 6–7 mm, oblong-elliptic, glabrous with age; petals 6–8 × 5–6 cm, broadly obovate, base shortly clawed. Stamens

many, fused to form a tube which is attached to the base of the corolla. Fruit 20–30 × 8–12 cm, ovoid, covered with pale green velvety hairs. Seeds embedded in a yellow, mealy pulp.

*Flowering and fruiting*: August to May; new leaves also appear at that time.

*Distribution and habitat*: Southern Oman, Dhofar, on the seaward slopes of Jebel Qara, where several trees are present. *Altitude*: ± 500 m. Distributed in tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen (N.), where it is known from two isolated trees at separate localities.

*Distribution map*: Fig. 159. *Illustration*: Plate 116a.

*Notes*: Found at a single locality, Wadi Hinna on Jebel Qara, where about 110 trees are present. Other than the above location a single tree is present at Dhalkut on Jebel Qamar (SW Dhofar). There is some argument over its native status in Oman and it has been suggested that the species may have been introduced from Africa. The flowers of *A. digitata* are nocturnal, short-lived and are unpleasant to smell. They are pollinated by fruit bats.

The baobab trees, together with some tamarind and *Ficus sycomorus* trees is an attractive amenity at Wadi Hinna. Wadi Hinna is rich in species and a good example of a dry, deciduous tropical woodland in Oman. The area is at threat from development and is in need of conservation. *A. digitata* is in cultivation at the Sultan Qaboos University Botanic Garden from wild collected seed from Wadi Hinna.

## Cultivated species

*Ceiba pentandra* (L.) Gaertn. (1791).

The kapok tree is introduced and cultivated as a landscape tree in Oman at Al Khuwan and Muscat areas. The white flowers are showy and attractive and the pendulous fruits dehisce at maturity scattering the woolly seeds. These are collected by local people and used as filling for cushions.

## 25. Malvaceae

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Key to the genera of Malvaceae in Oman

- A. Epicalyx present
  - B. Capsule cylindrical (up to 3 cm) .....2. **Abelmoschus**
  - B\*. Capsule globose to subglobose
    - C. Calyx and epicalyx with dark oil glands
      - D. Leaves shallowly 3-lobed; calyx with dark oil glands along the nerves .....4. **Cienfuegosia**
      - D\*. Leaves palmately 3–5-lobed; calyx with scattered dark oil glands .....5. **Gossypium**
    - C\*. Dark oil glands absent
      - E. Epicalyx 3 .....7. **Malva**
      - E\*. Epicalyx more than 3
        - F. Epicalyx enclosing the fruit at maturity (in Oman plants) .....6. **Pavonia**
        - F\*. Epicalyx not enclosing the fruit at maturity
          - G. Fruit a loculicidal capsule .....1. **Hibiscus**
          - G\*. Fruit schizocarpic with free mericarps
            - H. Leaves lobed with 3–5 deep lobes, then each lobe further 3–5 lobed with shallower lobes .....9. **Althaea**
            - H\*. Leaves ovate, not lobed .....10. **Malvastrum**
  - A\*. Epicalyx absent
    - I. Fruit a loculicidal capsule .....1. **Hibiscus**
    - I\*. Fruit schizocarpic, dehiscent or indehiscent
      - J. Fruit with mericarps dehiscing by apical slits .....8. **Abutilon**
      - J\*. Fruit with mericarps indehiscent or dehiscence irregular .....11. **Sida**

1. **Hibiscus** L. (nom. conserv.)  
About 200–300 species, distributed throughout the tropical and subtropical regions of the world

- A. Flowers red
  - B. Leaves linear to lanceolate, shallow dentate in the upper half of leaf. Flowers c. 1 cm across. Capsule subglobose .....6. **H. spartioides**
  - B\*. Leaves oblong, narrow, with irregularly dentate or lobed margins. Flowers c. 8 mm across. Capsule subglobose, valves impressed near the apex with edges raised. ....5. **H. somalensis**
- A\*. Flowers yellow or white
  - C. Capsule valves with a distinct awn at the apex .....3. **H. palmatus**
  - C\*. Capsule valves not as above .....

- D. Capsule 5-winged .....4. *H. vitifolius*
- D\*. Capsule not winged
  - E. All leaves entire, not lobed
    - E. Branches rigid, ending in spines. Leaves obovate to oblanceolate; stipules spinescent .....8. *H. scindicus*
    - F\*. Branches woody or herbaceous, not ending in spines. Leaves ovate-rhomboid to broadly obovate; stipules filiform, not spinescent .....7. *H. micranthus*
  - E.\* Lower leaves entire, upper leaves lobed
    - G. Upper leaves deeply 3-lobed, lobes lanceolate. Flowers white or yellow throughout. Calyx not enlarging or becoming scarious. Epicalyx absent .....2. *H. sidiformis*
    - G\*. Upper leaves 3-5-lobed, each lobe toothed to pinnately-partite. Flowers pale yellow to white, with a purple-crimson base. Calyx enlarging, inflating and becoming scarious in fruit. Epicalyx present. ....1. *H. trionum*

1. *Hibiscus trionum* L., Sp. Pl. 697 (1753).

*Description:* Annual herb, up to 60 cm, branched. Branches erect to spreading, stellate hairy. Leaves alternate, 25-35 long and broad, petiolate, lower leaves orbicular to broadly ovate, upper leaves palmately lobed into 3 deep lobes, each lobe further shallowly lobed, apex obtuse, margin irregularly dentate, stellate-pubescent; stipules linear. Epicalyx of 7-12 linear segments, hispid. Flowers 1.5-3 cm across, solitary, white-yellow with a purple base; calyx 12-15 mm, 5-lobed, purple-veined, persistent, inflated and enclosing the fruit; corolla 15-18 mm, obovate. Capsule oblong,  $\pm$  1.5 cm, villous. Seeds tuberculate.

*Flowering and fruiting:* July-August.

*Distribution and habitat:* Northern Oman, in the mountains and foothills, as a weed of cultivated land, weedy in gardens and waste places. *Altitude:*  $\pm$  1800 m. Distributed in the warmer regions of the Old World; introduced in America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 160. *Illustration:* Plate 117.

2. *Hibiscus sidiformis* Baill. in Bull. Soc. Linn. Par. 1: 518 (1885) (as *sidueformis*).

*Description:* Annual herb, up to 70 cm. Branches erect, tomentellous. Leaves alternate, petiolate, petiole 1-5 cm; lower leaves 5  $\times$  7 cm, orbicular, base cordate, margins crenate-dentate, upper leaves shallow to deeply 3-lobed, margin serrate to dentate; stipules linear. Epicalyx absent or minute. Flowers axillary, solitary, about 3 cm across, white or yellow; calyx 7-12 mm, 5-lobed, lobes triangular, green-veined; corolla 10-20 mm, obovate. Capsule 5-10 mm, subglobose, pilose. Seeds tuberculate.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, in the drier foothills, and rocky wadis, in the *Acacia-Commiphora* scrubland. *Altitude:*  $\pm$  250 m. Distributed from Ethiopia to Zimbabwe to Mozambique, Madagascar. Not reported elsewhere in the Arabian Peninsula.

*Distribution map:* Fig. 161.



*Notes:* A collection by Collenette from Dhotar, lower wadi Sayq, east of Dhalqut is different from the typical form of *H. californicus* being a perennial with decumbent to ascending stems and lemon-yellow flowers.

3. *Hibiscus palmatus* Forssk., Fl. Aegypt. Arab. 126 (1775).

*Description:* Annual or perennial herb, up to 35 cm. Branches prostrate to ascending, hispid hairy. Leaves alternate, 2–10 cm long and broad, petiolate; petiole 1–6 cm; leaves palmately lobed into 3–5 deep lobes, each lobe with apex obtuse, margin entire or irregularly dentate, crisped pubescent on the nerves. Epicalyx of about 8 linear segments, hispid. Flowers axillary, solitary, 1.5 cm across, pale-yellow with a purple base, calyx 8–10 mm, 5-lobed, green-veined; corolla  $\pm$  10 mm, obovate. Capsule subglobose,  $\pm$  10 mm long, sparsely pubescent, each valve with an apical awn 3 mm long. Seeds adpressed pubescent.

*Flowering and fruiting:* September?

*Distribution and habitat:* Southern Oman, Dhotar, on the escarpment mountains. *Altitude:* 450–600 m. Distributed in tropical and southern Africa, NE Africa (Somalia, Ethiopia, Eritrea) and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 162.

4. *Hibiscus vitifolius* L., Sp. Pl. 696 (1753).

*Synonyms:* *Fioria vitifolia* (L.) Mattei (1916).

*Description:* Annual herb or perennial subshrub, up to 1.5 m. Branches erect to ascending, pilose-pubescent, often glandular and prickly. Leaves alternate, 2–10 cm long and broad, petiolate; petiole 3–10 cm; leaves palmately lobed into 3–5(–7) lobes; lobes generally shallow, each lobe with an obtuse apex, margin serrate, pubescent to pilose. Epicalyx of about 10 linear segments, pilose. Flowers axillary, solitary or in racemes,  $\pm$  5 cm across, pale-yellow with a red-purple base, calyx 10–20 mm, 5-lobed, green-veined, corolla 2–5 cm, obovate. Capsule subglobose,  $\pm$  10 mm long, hispid, scarious, transversely veined, 5-valved, each valve conspicuously winged and provided with an apical awn about 5 mm long. Seeds glabrous, tuberculate.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhotar, on hill slopes with *Commiphora* spp. and *Euphorbia hadramifera*. *Altitude:*  $\approx$  600 m. Distributed in the tropics and subtropics of the Old World; introduced in America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 163.

*Notes:* Included under *Fioria* by Abedin (Flora of Pakistan, 1979).

5. *Hibiscus somaliensis* Franch., Revoil, Comali 17 (1882).

*Description:* Small shrub or woody herb, up to 50 cm. Branches erect to prostrate, hirsute. Leaves 10–20 mm long, oblong to ovate-oblong, base tapering to rounded, margin coarsely pinnately-lobed or irregularly dentate. Epicalyx of about 8 segments, 5–7 mm, linear. Flowers solitary, in the axils of leaves, red; pedicel 3–4 cm, articulated and bent near the apex; calyx 5–15 mm; petals red, tinged purple,  $\pm$  8 mm, ovate-oblong. Capsule  $\pm$  7 mm in diameter, subglobose, valves impressed near the apex with edges raised.

*Flowering and fruiting:* ?September.

*Distribution and habitat*: Northern and Southern Oman, in sandy and rocky areas and in gravelly wadis. *Altitude*: 250–350 m. Distributed in NE Africa (Somalia, Ethiopia) and NE Kenya. Elsewhere in the Arabian Peninsula found in Saudi Arabia. Also found in Soqatra.

*Distribution map*: Fig. 164. *Illustration*: Plate 118.

6. *Hibiscus spartioides* Chiov., Fl. Somal. 29 (1929).

*Description*: Small slender shrub, up to 1 m, branching from the base. Stems and branches sparsely hispid with adpressed hairs. Leaves 1–7 × 0.2–0.5 cm, linear to lanceolate, apex acute or rounded, base truncate, margin entire in the lower half, irregularly and shallowly dentate in the upper half of leaf. Epicalyx segments c. 8, 5–15 mm, linear. Flowers solitary, axillary, bright red; pedicel erect; calyx about as long as the epicalyx, sparsely adpressed hispid; corolla 10–15 mm, oblong. Capsule 10–11 mm in diameter, subglobose, puberulous.

*Flowering and fruiting*: ?September.

*Distribution and habitat*: Southern Oman, Dhofar, in the *Acacia-Commiphora* shrub land. *Altitude*: ± 500 m. Distributed in Somalia and Ethiopia. Not found elsewhere in the Arabian Peninsula, but expected to be present in eastern Yemen.

*Notes*: Known so far from a single collection from a seaward facing wadi in Jebel Qamar in Dhofar.

*Distribution map*: Fig. 165. *Illustration*: Plate 119.

7. *Hibiscus micranthus* L. f., Suppl. Pl. 308 (1781).

*Synonyms*: *Hibiscus ovalifolius* sensu auct., Boiss. (1867).

*Description*: Small shrub, up to 60 cm. Stems and branches densely stellate-pubescent with adpressed and stellate hairs. Leaves 12–20 × 10–18 mm, petiolate, broadly ovate, apex obtuse, base truncate, margin serrate, stellate-hairy. Stipules subulate, spinescent. Epicalyx ± 6 mm, lanceolate, setaceous. Flowers about 1.5 cm across, solitary, axillary, pale yellow to white; pedicel erect in fruit; calyx 6–8 mm, fused below; corolla ± 8 mm, obovate-oblong, reflexed at anthesis. Capsule subglobose, 7–9 mm in diameter, hirsute. Seeds covered with long white hairs.

*Flowering and fruiting*: February–April.

*Distribution and habitat*: Northern Oman, in the foothills of the northern mountains, in wadis and amongst stones, and on rocky hill slopes, with *Euphorbia larica* and *Acacia tortilis*. *Altitude*: 50–350 m. Distributed in tropical Africa, South Africa, Madagascar and tropical regions of India, Pakistan and Sri Lanka. Elsewhere in the Arabian Peninsula found in UAE.

*Distribution map*: Fig. 166.

*Notes*: A collection by A.G. Miller, M9206 B from Dhofar, Jebel Qara, (in woodland with *Commiphora*, *Croton confertus* and occasional *Boschnia arabica*), differs from the typical *H. micranthus* in having broader leaves (up to 2 cm) and pink flowers. There is a similar record from Yemen. With more material this may prove to be a new taxon.

8. *Hibiscus scindicus* Stocks in Hook.f., Icon. Pl. t. 802 (1951).

*Description*: Perennial subshrub or a woody herb, up to 30 cm, with intricate, somewhat spinous branches, scabrous to hispid. Leaves subsessile, 5–12 × 5–10 mm, obovate to oblanceolate.



apex obtuse, base tapering into the petiole, margin toothed above, entire below, stellate-hairy; stipules spinose. Epicalyx 3–5 mm, lanceolate. Flowers about 1 cm across, solitary, axillary, white or yellow; calyx 5–8 mm, fused below; corolla longer than the sepals. Capsule globose, 6–8 mm in diameter, puberulous. Seeds covered with long, white hairs.

*Flowering and fruiting*: August.

*Distribution and habitat*: Northern Oman, in the foothills of the eastern Hajar mountains, on sand near the coast. *Altitude*:  $\pm 20$  m. Distributed in SW Pakistan (Sind and Baluchistan). Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 167.

*Note*: This species is rare and localized in its distribution. It has been collected only once from this area. It was considered to be endemic to Sind and Baluchistan in SW Pakistan (from where the species is described) until it was recorded from Oman. The species is at a great risk from getting locally extinct (if not already so) due to the rapid development, road and housing construction in the area where it has been originally recorded.

### *Hibiscus* sp. A

*Description*: Erect annual to 50 cm. Stems glabrescent, hairs medifixed. Leaves petiolate, lamina 45 mm, rhomboid to 3-lobed, cordate at base, margin dentate; petiole and lamina pubescent with branched hairs. Flowers 1–2, red-yellow; pedicel 10 mm; bracts ovate; epicalyx 10–12 mm; sepals 10–12 mm, ovate, with simple or branched hairs; petals 3 cm. Ovary and fruit densely white pubescent.

*Distribution map*: Fig. 168.

*Note*: Only a single record from Dhofar, Sartait, in the dense escarpment woodland, collected by A.G. Miller 2675 (E, K).

### *Hibiscus* sp. B

*Description*: Decumbent shrub, up to 50 cm. Stems dark purple, pubescent with stellate hairs. Leaves petiolate, lamina 8–10 cm, rhomboid with 5 points, cordate at base, margins dentate; petiole and lamina pubescent with simple hairs. Flowers 1, pale-yellow with a maroon centre (becoming pinkish on drying); sepals 2 cm, petals 5 cm, obovate. Young fruits dark green.

*Distribution map*: Fig. 168.

*Note*: Only a single record from Dhofar, from Khadrafi, by roadside, collected by A. Radcliffe-Smith 5295 (K).

## 2. *Abelmoschus* L.

15 species, distributed in the tropics of the Old World.

A. Epicalyx lobes linear, persistent . . . . . 1. **A. esculentus**

A\*. Epicalyx lobes ovate, falling before the maturation of fruit . . . . . 2. **A. manihot**

1. *Abelmoschus esculentus* (L.) Moench, *Methodus*: 617 (1794).

*Synonyms*: *Hibiscus esculentus* L. (1753).

*Vernacular names*: şemērah (Jibbālī).

*Description:* Erect herb, up to 1 m. Stems tinged red. Leaves alternate, 10–20 cm, 5-lobed, the upper 3-lobes deeper. Epicalyx lobes 8–13, linear, persistent. Flowers solitary, in the axils of leaves, pale yellow with a dark red-crimson centre; calyx 1.5–2 cm, irregularly splitting into 2 lobes, attached to the corolla and falling along with it; petals imbricate, attached to the staminal column at the base, staminal column  $\pm$  2 cm; stamens fused to form a tube enclosing the style. Capsule 3–5 cm, cylindrical to ovoid, densely strigose.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, occurring on the escarpment woodlands and grasslands. *Altitude:* 50–500 m. Distributed and cultivated throughout the tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 169. *Illustration:* Plate 120.

*Notes:* The species is relatively common on the escarpment woodlands in Dhofar, where it appears to be native. It may be an escape from an early introduction or represents the wild strain, possibly a progenitor of the modern cultivated varieties. The origin of okra is not known but it has been cultivated in W Africa, Ethiopia and India since a long time. The majority of the cultivated forms are polyploid hybrids. Hybrids between the Indian and African okra are partially sterile.

## 2. *Abelmoschus manihot* (L.) Medic., Malven-Fam. 46 (1787).

*Vernacular names:* şemērah(Jibbālī).

*Description:* Very similar to *A. esculentus*, but differing in the epicalyx lobes which are ovate and fall before the maturation of the fruit.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment woodlands and grasslands. *Altitude:* 50–550 m. Distributed and cultivated throughout the tropics.

*Distribution map:* Fig. 170.

## 3. *Senra* Cav.

A single species, distributed from NE Africa through Arabia to India.

*Senra incana* Cav., Diss. 2: t. 35. f. 3. 83 (1786).

*Description:* Small perennial shrub or a woody herb, up to 1 m. Branches spreading, velvety pubescent. Leaves palmately 3(–5)-lobed, 1.5–5 × 2–6 cm, lobes broadly ovate, apex rounded, margin entire to crenate, 5–9-nerved; petiole 1–6 cm. Epicalyx 3-lobed, 2–2.5 long and broad, base cordate, becoming membranous and enclosing the fruit. Flowers solitary,  $\pm$  2 cm across, pale yellow with a dark purple or red centre; calyx  $\pm$  5 mm, 5-lobed; corolla 18 × 8 mm, spirally arranged. Capsule globose, 5–6 mm in diameter, 5-ribbed, 5-valved, dehiscent, enclosed by the enlarged epicalyx.

*Flowering and fruiting:* September–October.

*Distribution and habitat:* Southern Oman, Dhofar, in cultivated, irrigated and waste places, in sandy and scrub areas, and wadi beds. Common. *Altitude:* 20–300 m. Distributed from east Africa to Pakistan and Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 171. *Illustration:* Plate 121.



*Notes:* The flowers open during the early morning hours and are closed before noon. Cultivated at Sultan Qaboos University Botanic Garden, Oman from wild collected seed from Dhofar. The plants that I have seen in Oman are all pale yellow with a dark purple or red centre rather than purple-brown as photographed in Collenette (1999: p. 560). M. Thulin (*Flora of Somalia* Vol. 2: p. 56) records both colour forms from Somalia.

### 3. *Cienfuegosia* Cav.

About 20 species, distributed from Africa to Arabia, Madagascar and from South America to southern USA.

*Cienfuegosia welshii* (T. Anders.) Garcke in Eichl., Jahrb. Bot. Gard. Berl. ii: 337 (1883).

*Synonym:* *Hibiscus welshii* T. Anders. (1860).

*Description:* Annual or perennial herb. Stems erect to decumbent, up to 35 cm. Leaves  $\pm$  3 cm across, roughly orbicular in outline, shallowly 3-lobed with sinuate margins; petiole about as long as the leaves. Epicalyx of about 9 segments. Flowers solitary, about 3 cm across, yellow with crimson spots and a crimson centre; calyx  $\pm$  3 mm, dark gland dotted along the veins, vein crimson, persistent; petals 14–15 mm, obovate. Capsule 1.8–2 cm, green with crimson blotches.

*Flowering and fruiting:* September, October.

*Distribution and habitat:* Southern Oman, Dhofar, on exposed rocky slopes of the escarpment mountains. *Altitude:*  $\pm$  100 m. Endemic to southern Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 172.

*Notes:* The species is not common in Oman, and so far recorded only at a single locality at Mufhayl in Dhofar. Collenette (1999) remarks that in Saudi Arabia the species is over-grazed and is difficult to find it in flower. That may well be true for Oman as well.

### 4. *Gossypium* L.

About 50 species, distributed in the tropics. Some species widely cultivated.

A. Petiole, pedicel and epicalyx with black spots. Prostrate to ascending woody perennial. Seed without lint . . . . . ***G. stocksii***

A\*. Petiole, pedicel and epicalyx without black spots. Erect, woody to herbaceous perennial or annuals. Seed with lint

B. Epicalyx segments lacinate . . . . . ***G. hirsutum***

B\*. Epicalyx segments 6–8-toothed or -lobed . . . . . ***G. herbaceum***

*Gossypium stocksii* Masters, Hook. f., Fl. Brit. Ind. 1:346 (1874).

*Vernacular names:* ghazel, jibun, ʿosōr (Jibbālī), qaṭn, quṭn (also Zūfari Arabic).

*Description:* Perennial woody herb, with prostrate to ascending stems and branches up to 2 m, gland-dotted, sparsely stellate-pubescent. Leaves palmately 3–5-lobed, 2–6 × 3–7 cm, orbicular in outline, apex of lobes rounded and cuspidate, margins entire, sparsely stellate-pubescent, black gland-dotted. Epicalyx 3, 1.5–3.5 cm, each lobe segmented into 8–12 linear-lanceolate teeth, nerves red, gland-dotted; epicalyx becoming spinescent in fruit; calyx 6–8 mm, cup-shaped, with 5 shallow triangular teeth; corolla fused at the base, 2.5–3 cm, obovate, yellow

with a crimson centre. Capsule 1.8–2 cm, enclosed by the epicalyx, ovoid, beaked at the apex, gland-dotted, 3-valved, dehiscent. Seeds densely covered with short brown hairs.

*Flowering and fruiting*: October.

*Distribution and habitat*: Southern Oman, Dhofar, on the foothills and coastal plains. *Altitude*: 20–150 m. Distributed in Somalia, Pakistan. Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 173. *Illustration*: Plate 122.

*Notes*: The cotton on the seeds was used in Dhofar as cotton wool, soaked in medicinal oils and pastes or twisted and used as lamp wicks. Species of *Gossypium* (*G. herbaceum* L., Plate 123, *G. hirsutum* L.) have been cultivated in Oman for the cotton fibre, and are sometimes found as escapes. These can be separated on the characters given in the key above. Today in Oman there is no cultivation of cotton.

## 6. *Pavonia* Cav. (nom. conserv.)

About 250 species, distributed in the tropics and subtropics.

A. Leaves 3-lobed. Mericarps winged at the back .....3. *P. pirottae*

A\*. Leaves not lobed. Mericarps not winged

B. Mericarps with a single or double row of spines on the dorsal keel  
.....1. *P. glechomifolia*

B\*. Mericarps without spines

C. Flowers pale-yellow to creamy white .....4. *P. schweinfurthii*

C\*. Flowers pink .....2. *P. arabica*

### 1. *Pavonia glechomifolia* (A. Rich.) Garcke in Schweinf. Beitr. Fl. Aethiop. 54 (1867).

*Description*: Perennial shrub, up to 1.5 m, with erect stems, pubescent with long and short hairs. Stipules  $\pm$  4 mm, filiform. Leaves alternate, 30–40  $\times$  27–38 mm, broadly ovate, apex obtuse, base cordate, margin coarsely dentate; petiole 30–45 mm. Epicalyx of 5–7 segments, 11–15 mm, narrow-ovate. Flowers axillary, solitary, about 1.8 cm across, lemon yellow with a darker red centre; pedicel 20–30 mm; calyx  $\pm$  8 mm, 5-lobed, pubescent and ciliate; corolla  $\pm$  20 mm. Mericarps 5, 4–5 mm, puberulous, with a single or double row of spines on the dorsal keel (not seen).

*Flowering and fruiting*: ?September–October.

*Distribution and habitat*: Southern Oman, Dhofar, in a seaward facing wadi, amongst gravel and stones. *Altitude*:  $\pm$  350 m. Distributed in NE Africa (Sudan, Ethiopia, Somalia, NE Uganda, Kenya, NE Tanzania), Pakistan, NW India. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 174. *Illustration*: Plate 124.

*Notes*: This record is based on a single collection from Wadi Afal, west of Salalah.

### 2. *Pavonia arabica* Hochst. ex Steudl., Nomencl. Bot. ed.2, 2: 279 (1841).

*Description*: Woody annual or perennial subshrub, up to 1 m, with erect stems, pubescent, sometimes with glandular hairs. Stipules filiform. Leaves alternate, 8–40  $\times$  5–22 mm, ovate to ovate-oblong, apex obtuse, base cordate to rounded, margin entire to obscurely dentate at the apex; petiole up to 5 cm. Epicalyx of 9–12 linear segments, tomentose, persistent. Flowers



pink, solitary, axillary, pedicels jointed near the apex; calyx 3–6 mm, 5-lobed, stellate pubescent. Fruit subglobose; mericarps 5, villous, enveloped by the epicalyx when mature.

*Flowering and fruiting*: March–April; September–October.

*Description and habitat*: Throughout Oman, but more common in Dhofar, on sandy and gravelly areas and on stony hill slopes. *Altitude*: 250–400 m. Distributed in NE Africa (Ethiopia, Somalia), India, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 175. *Illustration*: Plate 125.

### 3. *Pavonia pirottii* Chiov., Ann. Bot. Roma 13: 401 (1915).

*Description*: Slender perennial shrub, up to 25 cm, with erect stems, pubescent, with scattered long hairs. Leaves alternate, deeply 3-lobed, lobes 4–10 × 2–3.5 mm, entire to dentate at the apex, petiole up to 2 cm. Epicalyx of 9–12 segments, 3–4 mm, linear-lanceolate. Flowers solitary, axillary, about 8 mm across, pale-yellow; pedicel up to 4 cm, articulate near the apex; calyx 2–3 mm, 5-lobed, pubescent and ciliate; corolla 5 mm. Mericarps 5–6 mm, distinctly 5-winged, wings with simple hairs on the ridges. Fruit enveloped by the epicalyx.

*Flowering and fruiting*: March–April; September–October.

*Description and habitat*: Southern Oman, Dhofar, on the seaward facing wadis and on rocky hill slopes. *Altitude*: 100–200 m. Distributed in NE Africa (Ethiopia, Somalia). Not recorded elsewhere on the Arabian Peninsula.

*Distribution map*: Fig. 176. *Illustration*: Plate 126.

### 4. *Pavonia schweinfurthii* Ulbr., Bot. Jahrb. Syst. 57: 165 (1921).

*Description*: Stout perennial shrub, up to 65 cm, with erect stems, stellate pubescent. Leaves alternate, 15–26 × 5–9 mm, ovate, apex obtuse to acute, base cordate, margin entire, stellate-hairy, petiole up to 20–35 mm. Epicalyx of 10–11 segments, 10–11 mm, linear. Flowers solitary, axillary, pale-yellow to creamy white, about 20 mm across; pedicel 25–50 mm, articulated to about 3/4 up from the base; calyx ± 4 mm, ovate-lanceolate; corolla 12 mm. Mericarps 3–4 mm, densely pilose at the back, enveloped by the epicalyx.

*Flowering and fruiting*: September–October.

*Description and habitat*: Southern Oman, Dhofar, in seaward facing wadis and hill slopes dominated by *Dracaena serrulata* and *Acacia etbaica*. *Altitude*: 100–200 m. Distributed in NE Africa (Ethiopia, Somalia). Not recorded elsewhere on the Arabian Peninsula.

*Distribution map*: Fig. 177. *Illustration*: Plate 127.

## Material insufficient

### *Pavonia* cf. *cristata* Schinz ex Gurke (1859).

*Description*: Low growing shrub, (browsed), up to 25 cm, with erect stems, pubescent. Stipules minute, linear. Leaves alternate, 10–15 × 5–15 mm, broadly-ovate, apex obtuse, base cordate, margin coarsely dentate; petiole 4–7 mm. Epicalyx of 5–6 segments, 4 mm, linear-lanceolate. Flowers solitary, axillary, yellow; calyx 4 mm; corolla 10 mm. Fruit not seen. (Mericarps sparsely puberulous, with 3 conical spines and 3 rows of hooked or curved prickles, with transverse ribs between the rows of prickles at the back).

*Flowering and fruiting:* ?September.

*Distribution and habitat:* Southern Oman, Dhofar, in a north facing gravel wadi. *Altitude:* 200 m. (Distributed in Somalia, Ethiopia, NE Kenya (*P. armitata*). Not recorded elsewhere on the Arabian Peninsula.

*Distribution map:* Fig. 178.

*Notes:* This record is based on a single collection from Wadi Gulgul, *Rudolf Hoffmann* 5557 (K). The material is inadequate to identify the species satisfactorily.

## 7. *Malva* L.

About 40 species, distributed in the temperate regions of the northern hemisphere and S America.

A. Flowers  $\pm$  6 mm across; pedicel 2–3 mm. Mericarps with reticulate venation, transverse ribs and crested margins . . . . . 1. *M. parviflora*

A\*. Flowers  $\pm$  2 cm across; pedicels 1–3 cm. Mericarps smooth, pubescent, without crested margins . . . . . 2. *M. neglecta*

1. *Malva parviflora* L., Demonstr. Pl. Hort. Uppsal. 18 (1753); Sp. Pl. ed. 2, 969 (1763).

*Description:* Annual herb, up to 50 cm. Stems prostrate to erect, sparsely stellate-pubescent to glabrescent. Stipules lanceolate, ciliate. Leaves 2–4  $\times$  2–4 cm, pubescent, orbicular in outline, base cordate, margin dentate to serrate; petiole 3–6 cm. Epicalyx 3, linear. Flowers white to pink, in axillary fascicles of 4–5; pedicel 2–3 mm; calyx 3–5 mm, enlarging in fruit, fused below, lobes ovate; corolla 5–7 mm, as long as or slightly longer than the calyx, obovate, notched at the apex. Capsule depressed globose, 4–6 mm in diameter, glabrous or pubescent, mericarps about 10, with reticulate venation and transverse ribs, margin crested.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, including Musandam, on open, disturbed and waste places, and irrigated fields. So far not recorded from Dhofar, but expected to be present in the drier regions of Dhofar. *Altitude:* 20–250 m. Distributed in S and W Asia, N Africa, Europe. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 179.

2. *Malva neglecta* Wallr., Syll. Pl. Nov. 1:140 (1824).

*Description:* Annual with a woody base or a perennial herb, branched, up to 20 cm. Stems and branches spreading to erect, stellate-pubescent. Leaves 25–30 cm long and broad, orbicular to reniform in outline, base cordate, margin dentate; petiole 2–3 cm. Epicalyx 3, linear. Flowers 1–4, axillary, pink; pedicel 1–3 cm; calyx  $\pm$  5 mm, fused below, lobes acute; corolla 7–10 mm, longer than the calyx, obovate, notched at the apex. Capsule globose, 6–7 mm in diameter, mericarps 13–15, smooth, pubescent, margin not crested.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in irrigated waste and disturbed places, not common. *Altitude:*  $\geq$  50–350 m. Cosmopolitan in distribution. Elsewhere in the Arabian Peninsula found in Saudi Arabia where it is recorded to be occasional.

*Distribution map:* Fig. 180. *Illustration:* Plate 128.



8. **Abutilon** Miller

About 100 species, distributed in the warm tropical regions.

- A. Mericarps (8–)10(–11) .....1. **A. fruticosum**
- A\*. Mericarps more than 11
  - B. Mericarps acute or acuminate at the back
    - C. Leaves conspicuously acuminate at apex, margins obscurely dentate. (Leaves 4–12 cm long) .....2. **A. mauritianum**
    - C\*. Leaves acute at apex, margins dentate to serrate
      - D\*. Pedicels and branches covered with glandular and long eglandular hairs. (Mericarps 20–30) .....5. **A. hirtum**
      - D. Pedicels and branches without glandular hairs
        - E. Mericarps erect at maturity, not spreading stellately. Seeds smooth .....6. **A. indicum**
        - E\*. Mericarps spreading stellately at maturity. Seeds with two tubercles .....3. **A. bidentatum**
  - B\*. Mericarps obtuse or truncate at the back .....4. **A. pannosum**

1. *Abutilon fruticosum* Guill. & Perr. in Guill., Perr. & Rich., Fl. Senegamb. Tent. 1: 70 (1831).

*Vernacular names:* munaqah, munaqqah.

*Description:* Perennial herb or undershrub, up to 1 m. Stems and leaves with velvety stellate-pubescence, grey-green. Leaves 1–8×1–7 cm, broadly ovate, apex obtuse, base cordate, margin irregularly denticulate-serrate; petiole as long as the blade; stipules filiform. Flowers solitary, about 2.5 cm across, pale-yellow; pedicel 0.5–5 cm; calyx 3–4 mm, 5-lobed, acute; petals 10–11 mm, obovate, notched at the apex. Mericarps (8–)10(–11), pubescent, 3-seeded.

*Flowering and fruiting:* March to April; September to October.

*Distribution and habitat:* Throughout Oman, on sandy and gravelly soils, in the foothills of the mountains, and in wadi beds. *Altitude:* 100–1450 m. Distributed from Africa, (drier regions) to Arabia, NW India, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 181. *Illustration:* Plate 129.

2. *Abutilon mauritianum* (Jacq.) Medic., Malv. 28 (1787).

*Synonyms:* *Sida mauritiana* Jacq. (1781).

*Description:* Perennial shrub, up to 1 m. Stems and branches covered with soft white pubescence. Leaves 4–12×3–9 cm, stellate-pubescent, apex acuminate, base cordate, margins slightly dentate. Flowers solitary, yellow or orange. Mericarps more than 20, spreading stellately, densely pilose when young, but almost glabrous at maturity, 2–3 seeded.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar. *Altitude:* 50–350 m. Distributed in tropical Africa, with the type collected from Mauritius, but apparently not recorded since from there (see Vollesen in *Fl. Ethiopia* 1995: 2(2):246). Not recorded elsewhere on the Arabian Peninsula.

*Distribution map:* Fig. 182.

**3. *Abutilon bidentatum*** Hochst. ex A. Rich., Tent. Fl. Abyss. 68 (1847).

*Synonyms:* *Sida (Abutilon) bidentata* Hochst. (in sched.).

*Description:* Shrub, up to 1 m. Stems with erect to spreading branches, with stellate and simple hairs. Leaves 2–15 × 1.5–12 cm, broadly ovate, apex acute, base cordate, margin irregularly serrate; petiole as long as the blade; stipules filiform. Flowers solitary,  $\pm$  2 cm across, pale yellow; pedicel 2–4 cm, elongating in fruit; calyx 5–7 mm, 5-lobed, acute; petals  $\pm$  8 mm obovate. Mericarps 13–16, spreading stellately at maturity, stellate pubescent on the margins, 3-seeded. Seeds with 2 soft tubercles.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, at lower altitudes on the escarpment mountains. Not common. Not recorded from northern Oman but is expected to occur there. *Altitude:*  $\pm$  100 m. Distributed in tropical Africa, India, Pakistan, China. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 183.

**4. *Abutilon pannosum*** (G. Forst.), Schtdl., Bot. Zeit. (Berlin) 9: 828 (1851).

*Synonyms:* *Sida pannosa* G. Forst. f. (1789); *Abutilon glaucum* (Cav.) Sweet (1826); *Abutilon muticum* (DC.) Sweet (1830).

*Description:* Perennial herb or shrub, up to 1.5 m. Stems and branches with velvety stellate hairs. Leaves 4–13 × 4–13 cm, broadly ovate, apex acute to acuminate, base cordate, margins irregularly serrulate to serrate, stellate-hairy on both surfaces; petiole as long as or shorter than the leaf blade. Flowers solitary, axillary, 3–4 cm across, yellow with a purple centre; pedicel 1–3 cm; calyx 7–12 mm, lobes ovate; corolla 1.5–2 cm, obovate, notched at the apex. Mericarps 24–28, hairy at the back, glabrous on the sides.

*Flowering and fruiting:* March, April.

*Distribution and habitat:* Northern and Southern Oman, on sandy and gravel soils, on waste ground at edges of cultivations. Distributed in Palestine, Iraq, Iran, Pakistan, India, N and NE Africa (Egypt, Sudan), Senegal, Nigeria. *Altitude:* 50–200 m. Elsewhere in the Arabian Peninsula found in Yemen.

*Distribution map:* Fig. 184.

**5. *Abutilon hirtum*** (Lam.), Sweet, Hort. Brit. ed. 1:53 (1826).

*Synonyms:* *Sida hirta* Lam. (1783).

*Description:* Perennial shrub or undershrub, up to 1 m. Stems erect with glandular and eglandular hairs; hairs dense and patent. Leaves 2.5–3 × 2.0–3 cm, densely glandular and stellate hairy, apex acute, base cordate, margin deeply serrate to crenulate; petiole as long as the blade; stipules linear-lanceolate. Flowers solitary,  $\pm$  2.5 cm across, yellow to orange yellow; pedicel 1–3 cm, elongating in fruit; calyx 6–9 mm, 5-lobed, lobes acute; corolla 11–13 mm, obovate. Mericarps 20–27, stellate-hairy, 2–3 seeded.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment hills. *Altitude:*  $\pm$  800 m. Distributed from Iran to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.



*Distribution map:* Fig. 185.

6. *Abutilon indicum* (L.) Sweet, Hort. Brit. ed. 1:54 (1826).

*Synonyms:* *Sida indica* L. (1756).

*Description:* Perennial shrub or undershrub, up to 2 m. Stems and branches tomentose with stellate and simple hairs. Leaves 2–18 × 1.5–16 cm, stellate-hairy, ovate, apex acute to acuminate, (base cordate), margins irregularly serrate to dentate, petiole as long or shorter than the blade. Flowers solitary, about 2 cm across, deep yellow to orange; pedicel 1.5–8 cm; calyx 7–9 mm, lobes lanceolate; petals 1–1.5 cm, obovate. Mericarps 15–20, with stellate and simple hairs.

*Flowering and fruiting:* March to May.

*Distribution and habitat:* Northern Oman, on the foothills of the northern mountains, in wadis, in sunny and gravelly soils, and as a weed of waste places. *Altitude:* 300–600 m. Distributed from Afghanistan to India. Not recorded elsewhere in the Arabian Peninsula.

*Distribution map:* Fig. 186.

*Note:* Hepper and Ellis (1994, p. 196) report that *A. indicum* is not recorded for the Arabian Peninsula. This species is probably introduced into Oman as a weed of cultivation.

9. *Althaea* L.

12 species, distributed from Europe to NE Siberia.

*Althaea ludwigii* L., Mant. 98 (1767).

*Description:* Prostrate to decumbent annual herb, up to 30 cm, branched, with stellate and simple hairs. Leaves orbicular in outline, ± 2 cm across, lobed with 3–5 deep lobes, then each lobe further 3–5-lobed with shallow lobes. Epicalyx of 8–10 linear segments, connate below. Flowers 1–2, axillary, white.; calyx 4–5 mm, enlarging in fruit, stellate-hairy; corolla longer than calyx by half. Fruit globose, flattened at the top, enclosed in the calyx, mericarps 8–10, grooved dorsally.

*Flowering and fruiting:* April.

*Distribution and habitat:* Northern Oman, in Musandam, on alluvial soil. *Altitude:* ± 1200 m. Distributed in W Asia, Mediterranean region, SW Pakistan (Baluchistan). Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 187.

*Note:* The species has been collected only from the summit plains of Jebel Harim in Musandam. It is expected to occur on the Hajar mountains.

10. *Malvastrum* A. Gray (nom. conserv.)

14 species, distributed in the tropics and warm regions of the world.

*Malvastrum coromandelianum* (L.) Garcke, Bonplandia 5:295 (1857).

*Synonym:* *Malva coromandeliana* L. (1753).

*Vernacular names:* shuwayb al hammām.

*Description:* Annual herb, up to 50 cm. Branches strigose, stellate-pubescent. Leaves 1–7 × 0.5–4 cm ovate, appressed pubescent with simple and stellate hairs, especially on the

nerves, apex acute, base rounded, margin coarsely serrate. Epicalyx of linear segments, strigose. Flowers 1–3, axillary, yellow; pedicel 2–5 mm; calyx 5–6 mm, lobes ovate, strigose; corolla obovate. Capsule globose, mericarps 8–14, with a dorsal beak, hairy on the dorsal face.

*Flowering and fruiting*: February to March.

*Distribution and habitat*: Northern Oman, in wadis and irrigated date gardens. Also reported from Dhofar. *Altitude*: 350–1900 m. Distributed in the tropical regions of the Old and New Worlds. Elsewhere in the Arabian Peninsula found in ?Yemen.

*Distribution map*: Fig. 188.

## 11. *Sida* L.

About 200 species, distributed throughout the tropics.

- A. Mericarps trigonous, with 2 awns at the apex . . . . . 2. *S. spinosa*
- A\*. Mericarps not as above
  - B. Capsule partially enclosed by the calyx. Mericarps reticulate on the dorsal surface . . . . . 3. *S. ovata*
  - B\*. Capsule not partially enclosed by the calyx. Mericarps smooth on the dorsal surface
  - C. Flowers solitary. Mericarps membranous, beaked at the apex . . . . . 1. *S. cordata*
  - C\*. Flowers in axillary clusters rarely solitary. Mericarps not membranous, obscurely beaked at the apex . . . . . 4. *S. urens*

### 1. *Sida cordata* (Burm. f.) Borss., Blumea 14(1):182 (1966).

*Synonyms*: *Melochia cordata* Burm. f. (1768); *Sida veronicifolia* Lam. (1783).

*Description*: Branched annual herb, up to 60 cm. Branches erect to decumbent, with stellate and simple hairs. Leaves 1–5 cm long and broad, ovate to lanceolate, apex acuminate, base rounded to cordate, margins crenate to dentate; petiole 1–3 cm; stipules filiform, strigose. Epicalyx absent. Flowers 2–8 mm across, axillary, solitary, pale yellow; pedicel 1–3 cm, stellate-hairy; calyx 4–5 mm, fused below, lobes acuminate, partially enclosing the capsule; corolla 2–10 mm, obovate. Capsule depressed globose, 3–4 mm in diameter, beaked at the top; mericarps 5, membranous, dehiscent, 1-seeded.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar. *Altitude*: ?250 m. Distributed in the tropics and subtropics. Not recorded elsewhere in the Arabian Peninsula but expected to be present in Yemen (South).

*Distribution map*: Fig. 189.

*Notes*: Recorded from Oman, but I have not seen any material from there.

### 2. *Sida spinosa* L., Sp. Pl. 683 (1753).

*Description*: Annual herb, up to 80 cm. Branches erect, stellate-hairy. Leaves 10–30 × 3–22 mm, ovate to lanceolate, apex obtuse or acute, base rounded, margin crenate to serrate; petiole 10–30 mm. Stipules filiform. Epicalyx absent. Flowers white, solitary, axillary; pedicel 2–5 mm, elongating in fruit; calyx 4–5 mm, fused below, lobes triangular, acute, corolla exceeding the calyx, obovate, hairy. Capsule depressed globose, pubescent above; mericarps 5, trigonous, membranous, with 2 awns at the apex, dehiscent.



*Flowering and fruiting*: January to February.

*Distribution and habitat*: Northern Oman, on the foothills and plains, as a weed of cultivated places. *Altitude*: 10–350 m. Distributed in the tropics and subtropics. Elsewhere in the Arabian Peninsula found in UAE, Yemen.

*Distribution map*: Fig. 190.

3. *Sida ovata* Forssk., Fl. Aegypt.-Arab. 124 (1775).

*Description*: Perennial herb, up to 80 cm. Branches erect, stellate-hairy. Leaves 2–5 × 1–4 cm, ovate to ovate-oblong, apex obtuse, base rounded, margins serrate to crenate; petiole ± 10 mm; stipules filiform to linear. Epicalyx absent. Flowers, 10–12 mm across, solitary, axillary, white; calyx 4–6 mm, fused below, lobes triangular, acuminate; corolla 2–8 mm, obovate, fruit depressed globose, 3–5 mm in diameter, partially enclosed by the calyx, mericarps 5, reticulately veined on the dorsal surface, provided with a small awn, indehiscent, 1-seeded.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Dhofar, Jebel Qara, on dry sandy locations. *Altitude*: 30–300 m. Distributed in Africa (dry regions), India, Pakistan, Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 191. *Illustration*: Plates 130, 131.

*Notes*: The name of this species is based on material collected from Yemen by P. Forsskal 1728 (selected lectotype C, isolectotype BM).

4. *Sida urens* L., Syst. Nat. ed. 10, 2: 1145 (1759).

*Description*: Perennial herb, up to 60 cm, branched from the base. Stems and branches erect to spreading, hispid to pilose. Leaves 6–7 × 4–5 cm, broadly ovate, apex acute, base cordate, margin serrate, pubescent to pilose; petiole about as long as the leaf blade. Epicalyx absent. Flowers usually in axillary clusters, rarely solitary, white to pale yellow; pedicel ± 10 mm; calyx 5–7 mm, 5-lobed, lobes triangular; corolla exceeding the calyx, obovate, notched or rounded at the apex. Mericarps 5, smooth on the dorsal surface, obscurely beaked at the apex.

*Flowering and fruiting*: March to April; September to October.

*Distribution and habitat*: Throughout Oman, by roadsides and in irrigated, cultivated and disturbed places, often weedy. *Altitude*: 50–350 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map*: Fig. 192. *Illustration*: Plate 132.

Cultivated species

*Alcea rosea* L. (1753)

*Synonym*: *Althaea rosea* (L.) Cav. (1790).

*Common English name*: hollyhock

A perennial shrub with showy pink and white flowers borne in racemes. Not commonly cultivated in Oman. Indigenous to the Aegean Islands and the Balkan Peninsula, and cultivated throughout the warmer regions of the world.

***Hibiscus rosa-sinensis* L. (1753).**

*Common name:* hibiscus.

Perennial shrub with large red, pink or yellow flowers. Commonly cultivated as a hedge in private and public gardens. Hibiscus is indigenous to S America, but is now cultivated throughout the warmer regions of the world.

**26. Cistaceae*****Bibliography***

Boissier, E. (1867). *Flora Orientalis* 1: 441–443.

***Helianthemum* Mill.**

About 110 species, distributed from Europe to the Sahara, NE Africa to C Asia, N and S America.

- A. Flowers sessile to subsessile .....2. ***H. lippii***
- A\*. Flowers pedicellate
  - B. Capsules glabrous. Annual herb ..... 1. ***H. salicifolium***
  - B\*. Capsule pubescent. Perennial subshrubs
    - C. Leaves 3–4×1–1.5 mm, linear to linear-lanceolate. Pedicels up to 3 mm  
.....3. ***H. kahiricum***
    - C\*. Leaves 11–20×4–8 mm, elliptic to ovate-elliptic. Pedicel up to 8 mm .....  
.....4. ***H. citrinum***

**1. *Helianthemum salicifolium* (L.) Mill., Gard. Dict. no. 21 (1768).**

*Synonyms:* *Cistus salicifolius* L. (1753).

*Description:* Annual herb, up to 30 cm. Stems procumbent to ascending or erect, grey-green, appressed stellate-hairy. Leaves opposite, 1–3×0.5–1.0 cm, obovate-oblong, apex acute, base rounded, margin entire, scarcely revolute; stipules linear-lanceolate. Flowers yellow, in terminal racemes; pedicels ± 10 mm, turning up at the top; bracts leaf-like, ovate, calyx 5, ± 4 mm, inner sepals green, ± 6 mm, ovate-lanceolate, about two times the length of outer sepals; petals smaller than the sepals; stamens many. Capsule 3–5 mm, ovoid, glabrous, 3-valved.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, including Musandam, in old plantations, on silty and stony soils in wadi beds. *Altitude:* 500–1000 m. Distributed in W and C Europe, Caucasus, Syria, Iran, Palestine. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 193.

**2. *Helianthemum lippii* (L.) Dum.-Cours., Bot. Cult. 3: 130 (1802).**

*Synonyms:* *Cistus lippii* L. (1771) as “lippii”.

*vernacular names:* biqan, birqan (also for other *Helianthemum* spp. and in eastern Hajar region), ruqruq; turērūn (Jibbālī, also for other *Helianthemum* spp.).

*Description:* Perennial woody subshrub, up to 30 cm, branched. Stems and branches erect to spreading, stellate-hairy, grey-canescens. Leaves opposite or whorled, in fascicles, 5–10×1–3 mm, lanceolate, apex acute, base rounded, margins revolute, stipules leaf-like. Flowers sub-



sessile, yellow;  $\pm 7$  mm across, in terminal, one-sided racemes; calyx 5,  $\pm 4$  mm, the larger 3 sepals with 3–4 brown veins, inner sepals twice as long as the outer ones, hairy; petals as long as the sepals, reflexed in daylight when flower fully open; stamens many. Capsule  $\pm 4$  mm, ovoid, pubescent, 3-valved.

*Flowering and fruiting:* May to September.

*Distribution and habitat:* Northern Oman, on the Western and Eastern Hajar mountains, and in Musandam, on stony hill slopes and rocky ground. Common above 1200 m in northern Oman. *Altitude:* 500–2000 m. Distributed in E Sudan, Egypt, Iraq, Iran, Pakistan and the southern Mediterranean region. Elsewhere in the Arabian Peninsula found in Saudi Arabia and the ?UAE.

*Distribution map:* Fig. 194. *Illustration:* Plate 133.

*Notes:* The habit of the plant and size of leaves is very variable in *H. lippii* and depends on the habitat where it grows. Plants growing in shaded locations, in general, have leaves that are larger with straight margins while plants in dry, sunny habitats have leaves that tend to be smaller and the margins in-rolled. Leaves produced in the growing season (March–June) are larger than the winter leaves. *H. stipulatum* (Forssk.) Christen. is very similar to *H. lippii* in habit and tissue, but has a red-green (not white-grey) bark, densely pubescent sepals and larger flowers. Material identified as *H. stipulatum* from Oman is referable to *H. lippii*.

3. *Helianthemum kabiricum* Delile, Fl. Aeg. Ill. 65 (1813).

*Synonyms:* *Cistus stipulatus* var. *B* Forssk. (1775).

*Description:* Perennial woody subshrub, up to 20 cm. Stems and branches stellate hairy, spreading, grey. Leaves opposite or whorled, in fascicles, 3–4  $\times$  1–1.5 mm, linear to linear-lanceolate, margins revolute, densely pubescent, grey-green; stipules minute, oblong, ciliate. Flowers yellow, about 7 mm across, in terminal, one-sided racemes; pedicels 2–3 mm; bracts linear; calyx 5,  $\pm 4$  mm, with 3 brown veins, densely pubescent; inner sepals longer than the outer ones; petals equal to or smaller than the sepals; stamens many. Capsule  $\pm 3$  mm, ovoid, pubescent.

*Flowering and fruiting:* September.

*Distribution and habitat:* Northern Oman, on the Western and Eastern Hajar mountains, in the Jebel Akfalhar range, on the Western Hajar, on slopes and on small sandy depressions amongst rocks. *H. kabiricum* and *H. lippii* are often found growing together, but *H. lippii* is more common than *H. kabiricum*. *Altitude:* 1500–1650 m. Distributed in Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia and ?UAE.

*Distribution map:* Fig. 195. *Illustration:* Plate 134.

*Notes:* A species described from S Yemen, *H. myureum* Baker based on a single collection, is very similar to *H. kabiricum*, and the two may be conspecific. The material of *H. myureum* present at K is not enough to establish the status of this species.

4. *Helianthemum citrinum* Ghaz., Willdenowia 32: 69–72 (2002).

*Type:* Oman: Dhofar, Jebel Qamar, 9 Oct. 1979, A.G. Miller 2619 (holotype E, isotype K).

*Description:* Perennial sub-shrub, up to 20 cm. Stems branched from the base, erect to ascending, spreading, white pubescent with simple and stellate hairs; young branches densely pubescent. Leaves opposite to sub-opposite, petiolate, 1–20  $\times$  4–8 mm, elliptic to ovate-elliptic, apex acute, base shortly cuneate, margin entire, sometime margin revolute, nerves depressed, mid-

rib prominent below; stellate-hairy on both surfaces; grey-green; petiole 2–4 mm, stellate white-hairy; stipules 5–7 mm, lanceolate; leaf fascicles often present in the leaf axils. Flowers in one-sided, bracteate, terminal racemes, pedicellate, pedicel up to 8 mm, elongating and pendulous in fruit, pubescent; bracts  $\pm$  2 mm, linear-lanceolate; sepals 5, unequal, pubescent; outer 2 sepals 2–3 mm, lanceolate; inner sepals 4.5–6.5 mm, ovate-lanceolate, enlarging in fruit, purple-tinged, with dark brown-purple veins; petals 5, clear-yellow, 3–4 mm, obovate, falling soon; stamens many; filaments  $\pm$  1.5 mm, free, glabrous; style simple, bent near the base; stigma crenate; ovary pubescent. Capsule 4.5–5 mm, ovoid, 3-valved, pubescent; seed  $\pm$  1 mm, angular, glabrous, minutely granulate, brown.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Southern Oman, Dhofar, in the drier areas, in the *Commiphora* scrubland, on open rocky and stony ground and on rocky plains. *Altitude*: 100–850 m.

*Distribution map*: 196. *Illustration*: Plates 135, 136.

*Notes*: *Helianthemum citrinum* is similar to *H. kahiricum* but differs in its larger leaves and from *H. lippii* in its pedicellate flowers. This species is not distributed in northern Oman. *H. aegyptium* Baker collected from south Yemen, is separated from *H. citrinum* by its narrower leaves and longer pedicels.

## 27. Violaceae

### *Bibliography*

Boissier, E. (1867). *Flora Orientalis* 1: 453–454.

### Key to the genera of Violaceae in Oman

- A. Woody-based annual up to 6 cm. Flowers with long slender peduncles 2–3 cm long ..... 1. *Viola*  
 A\*. Woody perennial up to 1 m. Flowers almost sessile ..... 2. *Hybanthus*

### 1. *Viola* L.

About 500 species, distributed in temperate regions.

*Viola cinerea* Boiss., Diagn. Pl. Or. ser. 1, 1, 7 (1842).

*Description*: Perennial or a long-lived annual herb with a woody base, up to 6 cm. Stems few, erect to ascending, pubescent with long or short adpressed hairs, with or without glandular hairs. Leaves variable in size, shape and pubescence, 0.8–2.5 × 0.3–1.4 cm, lanceolate to oblong-lanceolate to spatulate, pubescent to glabrous or pubescent only at the base, apex acute to apiculate, base tapering into a slender petiole 0.3–1.2 cm long. Flowers solitary on long slender peduncles, reflexed, peduncle 2–3 cm, glabrous or pubescent; sepals 0.4–0.8 mm, ovate-lanceolate, pubescent; petals pale pink to white with pink edges, lower petal white with purple veins, spur  $\pm$  0.1 cm, straight. Capsule elliptic-oblong, densely pubescent or glabrous, opening by 3 valves.

*Flowering and fruiting*: January to April.



*Duroyanthus and habitar*: Northern Oman and Dhofar, in the foothills and mountains, amongst rocks and stones. Common and flowering after rain. *Altitude*: 60–1650 m. Distributed in Egypt, Sudan, SW Pakistan, Afghanistan and Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map*: Fig. 197 (for both varieties). *Illustration*: Plate 137.

*Notes*: The plants produce annual leaves and flowers from a small woody stock. The annual growth dies back completely in the summer months. The species is recorded to be self-pollinated as well.

Two varieties are recognized separated on the pubescence of the stems, leaves and ovary. Both varieties flower and fruit at the same time and are found in the same habitats.

- A. Stems pubescent with long or short adpressed hairs, and a few glandular hairs. Leaves pubescent. Ovary pubescent .....1a. *V. cinerea* var. *cinerea*
- A\*. Stems glabrous or with sparse hairs. Leaves glabrous or pubescent only at the base. Ovary glabrous .....1b. *V. cinerea* var. *stocksii*

#### 1a. var. *cinerea*

*Type*: Hab. in monte Djebel Akhdar regni Mascatensis, *Aucher* 4199 (G).

#### 1b. var. *stocksii* (Boiss.) W. Becker in Beih. Bot. Zentrabl. 36: 37 (1918).

*Synonyms*: *Viola stocksii* Boiss. (1867); *V. somalensis* Engl (1892).

### 2. *Hybanthus* Jacq.

About 150 species, distributed in the tropics.

*Hybanthus durus* (Baker) O. Schwartz, Mitt. Inst. Bot. Hamburg 10: 170 (1939).

*Synonyms*:

*Description*: Perennial woody subshrub, branching from the base, up to 1 m. Branches spreading to erect. Leaves alternate, in fascicles, 5–15 × 2–6 mm, obovate, rounded, apiculate, base tapering into a short petiole, margin entire, glabrous. Flowers apparently axillary and solitary; calyx 2 mm, fused below, corolla of 5 unequal petals, the 4 upper petals 4–5 mm, more or less equal in size, violet-blue, curving upwards, the lower petal white, spurred at the base and extended into a long lip, lip  $\pm$  15 mm, orbicular, emarginate.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Southern Oman, Dhofar, occurring at the drier fringes of the wet escarpment woodlands, in the *Acacia-Commiphora* scrubland. *Altitude*: 600–900 m. Distributed in Somalia and E Ethiopia. Elsewhere in the Arabian Peninsula found in SE Yemen.

*Distribution map*: Fig. 198. *Illustration*: Plate 138.

*Notes*: The species is recorded to be widespread but it is not common in the woodlands in Dhofar. At present it is not on the Oman National Red List, but may well qualify for the Least Concern (LC) category. More distribution data is required to assess its full status.

## 28. Tamaricaceae

*Bibliography*

- Baum, B.R. (1978). *The genus Tamarix*, pp. 1–209. Israel Academy of Sciences & Humanities, Jerusalem, Israel.
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**Tamarix L.**

87 species, distributed in Eurasia, N Africa; common in the Mediterranean and central Asia.

- A. Leaf margins fused, green branches thus articulating
- B. Stamens 5 ..... 3. *T. aphylla*
- B\*. Stamens 10 ..... 4. *T. stricta*
- A\*. Leaf margins not fused, although leaves may be stem claspings, green branches not articulating
- C. Stamens 5
- D. All staminal filaments more or less confluent with the disc lobes ..... 2. *T. mascatensis*
- D\*. One or two staminal filaments inserted from below the disc, the others in between ..... 1. *T. arabica*
- C\*. Stamens 11–12 ..... 5. *T. aucheriana*

1. *Tamarix arabica* Bunge, Tent. 55 (1852).

*Vernacular names*: athel.

*Description*: Large shrub or small tree, up to 3 m. Young branches brown to red-brown, not articulated. Leaves sessile, grey-green, reduced, triangular, not encircling the stem but partially clasping it. Flowers pink or white tinged with pink,  $\pm$  2 mm, in dense, spiciform racemes, bracts longer than the pedicel; sepals 1 mm, denticulate; petals  $\pm$  1.5 mm, obovate, caducous; stamens 5 with 1 or 2 staminal filaments inserted from below the nectariferous disc, the others in between. Fruit triangular, red-green.

*Flowering and fruiting*: March to April.

*Distribution and habitat*: Throughout Oman. Common in dry wadi beds and on disturbed, poorly drained soils. *Altitude*: 60–350 m. Distributed in Egypt, NE Africa, Palestine, Jordan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, ?UAE.

*Distribution map*: Fig. 199.

*Notes*: The name of this species is based on material collected from Yemen by Botta (holotype P, isotypes G, K, P).

2. *Tamarix mascatensis* Bunge, Tent. 60 (1852).

*Type*: [Oman], Mascate, *Aucher-Eloy* 4912 (holotype W, isotypes FI, G, P, BM).

*Vernacular names*: athel.

*Description*: Large shrub, up to 3 m. Young branches grey-brown to brown, glabrous, not articulated. Leaves green, leaf margins not fused to the stem, triangular with often a recurved apex. Flowers pink or white tinged with pink,  $\pm$  3 mm, in loosely flowered racemes, bracts  $\pm$  1 mm,



linear; pedicel shorter than the calyx; sepals  $\pm 1$  mm, finely denticulate; outer 2 keeled; petals  $\pm 2$  mm; stamens 5 with all staminal filaments more or less confluent with the disc lobes.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Throughout Oman and including Halmiyah Island. Grows in sandy and saline soils, in wadi beds. *Altitude*: 50–300 m. Distributed in Somalia, Ethiopia, Iran, Pakistan and the Caucasus. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 200.

*Notes*: Very similar and difficult to tell apart from *T. arabica*, but distinguished by the filaments which are more or less confluent with the disc lobes.

3. *Tamarix aphylla* (L.) G. Karsten, Deutsch. Fl.: 641 (1882).

*Synonyms*: *Thuja aphylla* L. (1755) p.p.; *Tamarix orientalis* Forssk. (1775); *T. articulata* Vahl (1791), nom. illegit.

*Vernacular names*: athel; bēneh, tertāl (Zufari Arabic).

*Description*: Tree, up to 20 m. Trunk straight, well developed, bark brown to grey. Branches articulate in appearance. Leaves grey-green,  $\pm 2$  mm, scale-like, reduced and without a lamina, encircling the stem evenly, covered with salt secreting glands, glabrous. Flowers pink or white tinged with pink,  $\pm 2$  mm, in short terminal racemes. Bracts triangular,  $\pm 1$  mm. Pedicel shorter than the calyx; sepals 5, 1.5 mm, almost free; corolla  $\pm 2$  mm, falling soon. Stamens 5, attached inbetween the lobes of the disc. Capsule  $\pm 3$  mm, pyriform, many-seeded.

*Flowering and fruiting*: February to May.

*Distribution and habitat*: Throughout Oman, in sandy areas, wadi beds, and by water courses. Cultivated in the Muscat capital area as a landscape tree. *Altitude*: 50–350 m. Distributed from the Mediterranean region to southern Africa, Arabia, Iran Iraq, Afghanistan, Pakistan. Introduced in the New World. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 201. *Illustration*: Plate 139.

4. *Tamarix stricta* Boiss., Diagn. Pl. Or. ser. 2: 57 (1856).

*Vernacular names*: athel.

*Description*: Tree or large shrub, 3–5 m. Bark brown-grey. Branches glabrous, articulating. Leaves vaginate, 2–3 mm, closely sheathing, ending in a small acute tip. Flowers pink or purple-pink,  $\pm 2$  mm, in terminal racemes; bracts triangular  $\pm 1.5$  mm; pedicels shorter than the sepals; sepals  $\pm 2$  mm, denticulate; petals  $\pm 2$  mm; stamens 10, filaments alternately short and long; disc 10-lobed, lobes adnate to the filaments. Fruit many-seeded.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman, in the foothills of the mountains, in dry and stony wadi beds and sandy depressions. *Altitude*: 50–100 m. Distributed in SW Pakistan and southern Iran. Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 202.

*Notes:* The name of this species is based on material collected from Sind and Baluchistan by G.E. Stocks (holotype G; isotypes CGE, G, K, P, W).

5. *Tamarix aucheriana* (Decne.) Baum, Monogr. Rev. Tamarix: 148 (1978).

*Synonyms:* *Trichauxis aucherianus* Decne. ex Walpers (1843); *Tamarix puberuloides* Boiss. (1867), non Del. ex Desv.

*Vernacular names:* áthel.

*Description:* Large shrub, up to 2 m. Bark black to purple-black. Young branches brown, not articulated. Leaves green, somewhat fleshy, sessile,  $\pm$  2 mm, not encircling but clasping the stem, triangular with often a recurved apex. Flowers bisexual, pink or white tinged with pink,  $\pm$  3 mm, in terminal bracteate racemes; bracts  $\pm$  1 mm; pedicel as long as or longer than the calyx; calyx 5, green, ovate-deltoid, denticulate, free or fused basally, keeled at the back; petals 3–5 mm; stamens 11–12, 5 with long filaments alternating with 5 shorter filaments, inserted on a 10-crenately-lobed, fleshy disc. Capsule 10–13 mm, triangular, red-green, 3-valved. Seeds with a tuft of apical hairs.

*Flowering and fruiting:* April to September/October.

*Distribution and habitat:* Northern and Central Oman. Common in saline depressions at sea level and on sandy soils, and at the edges of sea inlets and littoral swamps. *Altitude:* 10–50 m. Distributed in Iraq, Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE.

*Distribution map:* Fig. 203.

*Notes:* The name of this species is based on material collected from Iran and Afghanistan by P.R.M. Aucher-Eloy 4509 (holotype P; isotypes FI, G, K, W).

## 29. Frankeniaceae

### *Bibliography*

Mandaville, J.P. (1990). Frankeniaceae. *Flora of Eastern Saudi Arabia*, p. 123. Kegan Paul, London.

### *Frankenia* L.

About 25 species, distributed in Europe and the subtropics.

*Frankenia pulverulenta* L., Sp. Pl. 332 (1753).

*Description:* Annual herb, up to 30 cm, with prostrate to ascending stems. Stems and leaves covered with excreted salt crystals, puberulent. Leaves opposite or whorled, 2–6  $\times$  0.1–0.3 cm, oblong to oblanceolate, apex obtuse to retuse, base tapering into the petiole, margins sometimes revolute. Flowers pink, solitary or in lax cymes, calyx tubular, 3–4 mm, ribbed; petals 5, obovate, exserted from the calyx; stamens 6. Capsule  $\pm$  2 mm, ovoid, 3-valved.

*Flowering and fruiting:* March to May.

*Distribution and habitat:* Northern Oman, including Musandam, in cultivated date plantations and irrigated sandy places, often near water. Common and often becoming weedy. *Altitude:* 20–150 m. Also distributed in Siberia, S and SE Europe, Africa, Turkey, Iran and Pakistan.



Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 204.

### 30. Cucurbitaceae

#### *Bibliography*

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#### Key to the genera of Cucurbitaceae of Oman

- A. Ovary developing a cup-like base . . . . . 1. **Corallocarpus**  
 A\*. Ovary not developing a cup-like base  
 B. Leaves ovate or palmately 3–5-lobed, with the lobes not pinnately lobulate  
 C. Tendrils simple or absent  
 D. Fruit 8–9 mm in diameter, red when ripe  
 E. Petiole base persistent, becoming hard and spine-like. Fruit solitary . . . . . 2. **Zehneria**  
 E\*. Petiole base not becoming hard and spine-like. Fruits in axillary clusters . . . . . 6. **Mukia**  
 D\*. Fruit 4–5 cm in diameter, green or yellow when ripe . . . . . 3. **Cucumis**  
 C\*. Tendrils 2–5(–6)-fid.  
 E. Fruit 10-ribbed, dry and fibrous . . . . . 7. **Luffa**  
 F\*. Fruit subglobose, not ribbed, fleshy, glabrous, green with white longitudinal markings . . . . . 5. **Diploscyos**  
 B\*. Leaves deeply 3–5-lobed, with the lobes pinnately lobulate . . . . . 4. **Citrullus**

#### 1. **Corallocarpus** Welw. ex Hook. f.

18 species, distributed in tropical and southern Africa, Madagascar, SW Asia and India.

- A. Scandent shrub. Stems without ridges; tendrils present, simple . . . . . 1. **C. epigaeus**  
 A\*. Small shrub, not scandent. Stems ridged; tendrils absent . . . . . 2. **C. glomerulifolius**

#### 1. **Corallocarpus epigaeus** (Roettl.) Hook. f. ex Clarke in Hook. f., *Fl. Brit. Ind.* 628 (1879).

*Synonyms*: *Bryonia epigaea* Roettl. (1803).

*Vernacular names*: Ixrum eljot (Jibbālī); itṣenī (Iḥarsūsī).

*Description*: Monoecious. Scandent woody herb up to 4 m. Stems glabrous, with a papery bark, tendrils simple. Leaves 2–8 × 3–11 cm, ovate to reniform, deeply 3–5-lobed, lobes 3-lobulate, hispid, cordate at base, margins dentate-sinuate. Male flowers several in pedunculate clusters; female flowers solitary in the axils of leaves. Hypanthium campanulate. Peduncle 1–6 cm, pedicel 2–5 mm; sepals  $\pm$  1 mm; petals  $\pm$  3 mm, greenish-yellow to pale yellow. Ovary developing a cup-like structure at the base. Fruit 5–6 mm, glabrous, ovoid, with a slender

apical beak, green with dark to pale green spots, becoming red when ripe except for the green cup at the base.

*Flowering and fruiting*: September; March to April.

*Distribution and habitat*: Northern and Southern Oman, on dry, rocky hill slopes and dry wadi beds. *Altitude*: 100–800 m. Distributed in the NE and parts of W Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, ?UAE.

*Distribution map*: Fig. 205. *Illustration*: Plate 140.

2. *Corallocarpus glomeruliflorus* (Dcfl.) Cogn. in Engl. Pflanzenr. 4, 275 (1 + 174 (1916)).  
*Synonyms*: *Phialocarpus glomeruliflorus* Dcfl. (1895); *Kedrostis glomeruliflora* (Dcfl.) Jeffrey (1962).

*Description*: Monoecious. Small shrub up to 40 cm. Stems swollen, woody, succulent, ridged. Leaves 7–18 × 7–18 mm, reniform or shallowly 3-lobed, hispid, cordate at base, margins minutely denticulate or sinuate; tendrils absent. Male flowers in small sessile clusters; female flowers solitary in the axils of leaves. Hypanthium urceolate; petals  $\pm$  3 mm, greenish-yellow. Fruit  $\pm$  15 mm, ovoid, with a cup at the base, softly pubescent, red when ripe.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, in rocky areas on the foothills of the escarpment mountains. *Altitude*: 50–550 m. Distributed in NE Africa and parts of W Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (SE).

*Distribution map*: Fig. 206. *Illustration*: Plates 141–143.

*Notes*: This species is found only at a few locations in the foothills of Jebel Qara in Dhofar. It is an unusual looking plant and can be at threat from over-collection by collectors and succulent enthusiasts. The name of this species is based on material collected from Arabia by G. Schweinfurth 449, and from Aden by Defflers 323, 519 (syntypes P).

## 2. *Zehneria* Endl.

30 species, distributed in the Old World Tropics.

*Zehneria anomala* C. Jeffrey, Kew Bull. 15(3): 364, f. 3 (1962).

*Description*: Monoecious or dioecious woody climber; tendrils simple, opposite the leaves. Leaves thick and fleshy, 1–3 × 1.5–6 cm, ovate, palmately 3–5-lobed, lobes varied in shape but generally ovate, base cordate, margins entire, petiole up to 15 mm with the base persistent and becoming hard and spine-like. Male flowers axillary, in subsessile clusters; female flowers solitary. Hypanthium campanulate,  $\pm$  2.5 mm, petals greenish-yellow,  $\pm$  1.8 mm; stamens 3; ovary ovoid-fusiform. Fruit 8–9 × 5–7 mm, subglobose, green with darker green stripes, red when mature.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, on the escarpment mountains. *Altitude*: 500–850 m. Distributed in NE and E Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, E Yemen.

*Distribution map*: Fig. 207.



*Notes:* The plant is not common on the mountains of Dhofar.

### 3. *Cucumis* L.

About 30 species, distributed in the Old World tropics, mainly tropical and southern Africa.

- A. Ovary and fruit sparsely pubescent or glabrous, smooth . . . . .1. *C. melo*
- A\*. Ovary and fruit with soft spines, warts, bristles or tubercles
- B. Ovary and fruit covered with tubercles
  - C. Leaves 12–18 cm, shallowly 3–8-lobed or angled; lobes acute. Fruit oblong, sparsely covered with small bristly tubercles . . . . .2. *C. sativus*
  - C\*. Leaves deeply 3-lobed, lobes with coarsely dentate margins. Fruit subglobose, covered with spiny, white-tipped warts . . . . .3. *C. pustulatus*
- B\*. Ovary and fruit covered with soft spines
  - D. Leaves 3–5-lobed with the lobes lobulate or dentate; tendrils present, simple . . . . .4. *C. prophetarum*
  - D\*. Leaves orbicular to suborbicular, not lobed; tendrils absent . . . . .5. *C. canoxyia*

#### 1. *Cucumis melo* L., Sp. Pl. 1011 (1753)

subsp. *agrestis* (Naud.) Pangalo, La Turquir Agricolr. 534 (1933).

*Vernacular names:* baṭṭikh, feqawz.

*Description:* Monoecious. Annual herb with trailing stems up to 1 m, hispid. Leaves 2.5 × 2.7 cm, broadly ovate or palmately 3–5-lobed, base cordate, margins sinuate, lobes obovate to ovate, scabrid to hispid, tendrils branched. Hypanthium campanulate, hispid. Male flowers yellow, solitary or in clusters, pedicellate; female flowers solitary, pedicellate, yellow. Ovary ovoid, finely puberulous. Fruit oblong, glabrous, 4–5 cm, pale yellow when ripe. Flesh bitter.

*Flowering and fruiting:* September, October, after the monsoons.

*Distribution and habitat:* Southern Oman, Dhofar, on the coastal plains, and at edges of wadis.

*Altitude:* 20–500 m. Distributed in NE and E Africa. Elsewhere in the Arabian Peninsula found in ?Saudi Arabia, SE Yemen.

*Distribution map:* Fig. 208. *Illustration:* Plate 144.

*Note:* The species illustrated in Miller & Morris (1988, p. 123, figs. 1a–1d) is referable to *C. melo* subsp. *melo* which has long hairy ovaries and a sweet edible flesh. The species described above is from wild plants collected from Wadi Sayq, Dhofar which have glabrous fruit and bitter flesh.

#### 2. *Cucumis sativus* L., Sp. Pl. 1012 (1753).

*Vernacular names:* khigār, kheyar; ḥashwey (Zufari Arabic); alṣebe elhuti (Jibbālī).

*Description:* Monoecious. Annual herb with climbing or trailing, stems up to 3 m. Stems ribbed, scabrid; tendrils simple. Leaves 12–18 cm, broadly ovate, base cordate, shallowly 3–8-lobed or angled; lobes acute. Flowers bright yellow, 3–4 cm across; male flowers 3–5, in axillary clusters, pedicel 3–20 mm, slender; sepals ± 4 mm, 5-lobed, lobes ovate, hispid; petals 5, fused at the base, 15–20 mm, obovate; female flowers usually solitary, pedicel 1–2 cm; sepals and petals same as in the male flowers; ovary globose, covered with small fleshy tubercles each with a bristle at top. Fruit 5–7 × 5 cm, cylindrical to oblong, green, sparsely covered with short bristles. Mesocarp fleshy, bitter, with many seeds.

*Flowering and fruiting:* September, after the monsoons.

*Distribution and habitat*: Southern Oman, Dhofar in the wet escarpment mountains, trailing on the ground or climbing on shrubs and trees. *Altitude*: 100–800 m. Distributed in the tropics. Elsewhere in the Arabian Peninsula found in SE Yemen.

*Distribution map*: Fig. 209. *Illustration*: Plate 145.

*Notes*: Cucumber is cultivated throughout the warm countries for its edible fruit which is eaten raw in salads. The wild cucumber is bitter and not edible. (See Miller & Morris, 1988, p. 122 for details on uses).

3. *Cucumis pustulatus* Hook. f. in Oliv., Fl. Trop. Africa 2: 544 (1871).

*Synonymys*: *Cucumis figarai* sensu auct., non Del. ex Naud (1859).

*Description*: Monoecious. Annual or perennial herb with trailing and climbing stems, reaching up to 5 m, scabrid; tendrils simple, opposite the leaves. Leaves petiolate, petiole 5–15 mm, lamina roughly ovate, cordate, lobulate to deeply 3-lobed, grey-green, hispid on both surfaces, nerves prominent and pale-green beneath; lobes 3–4 cm long and broad, margin irregularly dentate with small spines. Flowers yellow; calyx linear; petals  $\pm$  10 mm, obovate; female flowers solitary. Ovary ellipsoid, tuberculate. Fruit subglobose, 6  $\times$  4 cm, glabrous with pale-green, white-tipped warts.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Southern Oman, Dhofar, recorded from a seaward wadi. Not common and recorded only once but perhaps overlooked. *Altitude*: 450–1000 m. Distributed in Somalia, Ethiopia and Eritrea. Not recorded elsewhere in the Arabian Peninsula but expected to occur in SE Yemen.

*Distribution map*: Fig. 210. *Illustration*: Plate 146.

4. *Cucumis prophetarum* L., Cent. 1: 32 (1755).

subsp. *prophetarum*

*Type*: Arabia, *Aucher Eloy* 4503 (G. G-Boiss., P), *Bornmüller* 358 (syntypes IY, isosyntypes K).

*Synonymys*: *Cucumis mascatensis* Gandoger (1918). Type as above.

*Vernacular names*: ḥanayzal, ḥanzal.

*Description*: Monoecious. Annual herb with climbing or trailing stems, up to 1.5 m, hispid with appressed or patent hairs; the whole plant grey-green; tendrils simple. Leaves 3–5-lobed, 1.5–3  $\times$  1.0–1.5 cm, base cordate, lobes lobulate or dentate, hispid on both surfaces. Hypanthium  $\pm$  3 mm. Flowers yellow; male flowers 2–3 together, pedicel 3–10 mm, slender; sepals 1–3 mm, filiform; petals 5–6 mm, obovate; female flowers solitary, sepals and petals same as in the male flowers. Ovary ellipsoid, provided with soft spines. Fruit globose, 3–5 cm in diameter, globose to ovoid, soft spiny, glabrous or sparsely pubescent, with longitudinal green and yellow stripes, or uniformly yellow.

*Flowering and fruiting*: April; September to October.

*Distribution and habitat*: Throughout Oman, including the offshore islands, Masirah and Halaniyah. Common on sandy and gravel soils and in wadi beds. Also found in the central gravel desert and at the edges of sandy deserts. *Altitude*: 50–1000 m. Distributed in N Africa, and from Arabia to India. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 211. *Illustration*: Plates 147–149.



*Notes:* The plant material that I have examined from northern Oman and Dhofar falls under *C. prophetarum* subsp. *prophetarum* which is differentiated by its grey-green plants with small (up to 4 mm) sparse soft spines as apposed to dense and longer fruit spines (4–6 mm) and leaves that are deeply dissected in *C. prophetarum* subsp. *dissectus* (Naud.) C. Jeffrey (1962) (Plate 149).

5. *Cucumis canoxyi* M. Thulin & A.N. Al-Gifri, Nord. J. Bot. 14(3): 315 (1994).

*Description:* Monoecious. Annual herb with trailing stems, up to 50 cm, scabrid; tendrils absent. Leaves petiolate, petiole 25–40 mm; lamina 25–40 mm long and broad, suborbicular, base cordate, margin dentate, white-scabrid-pilose on both surfaces and on the nerves. Flowers yellow, pedicel  $\pm$  5 mm; calyx 1.5 mm, 5-lobed; petals 7 mm. Ovary subglobose, covered with soft spines. Fruit globose to ovoid,  $\pm$  3 cm in diameter, glabrous, covered with soft spines.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, recorded from a seaward facing wadi. Not common and recorded only once. *Altitude:*  $\pm$  450 m. Elsewhere in the Arabian Peninsula found in the Hadramaut, S Yemen, from where the species is described.

*Distribution map:* Fig. 212. *Illustration:* Plate 150.

*Notes:* The name of this species is based on material collected from Hadramaut, Yemen, by Thulin, Erikson, Gifri and Langtröm 8299 (holotype K, isotype UPS).

4. *Citrullus* Eckl. & Zehy. (nom. conserv.)

3 species, distributed in the arid parts of the African tropics and in the Mediterranean region. Some species cultivated.

- A. Fruit globose, 5–9 cm in diameter, yellow or variously green and yellow striped, smooth. Flesh white, bitter. Not cultivated . . . . .1. *C. colocynthis*
- A\*. Fruit globose to ovoid, up to 30 cm in diameter, generally green. Flesh red, sweet. Cultivated . . . . .2. *C. lanatus*

1. *Citrullus colocynthis* (L.) Schrad., Linnaea 12: 414 (1838).

*Synonyms:* *Cucumis colocynthis* L. (1753).

*Vernacular names:* linzil.

*Description:* Perennial herb with prostrate, creeping stems, up to 2 m; tendrils simple. Whole plant scabrid. Leaves alternate, ovate to cordate in outline, 4–10×2–6 cm, deeply palmately 3–5-lobed with the lobes further pinnately lobed, apex obtuse to acute, base cordate, margin ~~impe-~~impe-inate, hispid. Hypanthium obconical. Flowers solitary, axillary, about 2 cm across, calyx 2–4 mm, lanceolate; petals 7–12 mm, obovate, greenish-yellow. Fruit globose, 5–9 cm in diameter, yellow or with variously green and yellow stripes, smooth. Seeds imbedded in white flesh, seeds and flesh bitter.

*Flowering and fruiting:* February–April.

*Distribution and habitat:* Throughout Oman, common on sandy, silty or gravelly grounds, dry wadi beds and sandy depressions, with *Acacia tortilis*, *Rhazya stricta*, *Tephrosia apollinea* and other desert shrubs. *Altitude:* 0–500 m. Distributed from N tropical Africa to SW India. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 213. *Illustration:* Plate 151.

*Notes:* Well known and used as a purgative in traditional medicine in Arabia since early times; also used as a poultice for bites and stings.

### Cultivated species

*Citrullus lanatus* (Thunb.) Mansf. (1959).

The water melon is commonly cultivated in farms on the Batinah and is sometimes found as an escapee in irrigated and waste places.

### 5. *Diploscyos* (Endl.) Post & O. Kuntze

5 species, distributed in tropical Africa, Asia and Australasia.

*Diplocyclos palmatus* (L.) C. Jeffrey, Kew Bull. 15(3): 352 (1962).

*Synonyms:* *Bryonia palmata* L. (1753).

*Description:* Monoecious. Perennial herb with climbing or trailing stems, up to 5 m; tendrils 2-fid. Leaves 8–9 cm, palmately 3-lobed, base cordate, lobes ovate to elliptic, with the lateral lobes further lobed, margins spiculate, scabrid; Flowers white, about 1 cm across; pedicels filiform, elongating in fruit; male flowers: 4–5 together, axillary; sepals  $\pm$  2 mm, linear; petals 6–9 mm, white with green nerves; female flowers solitary in the axils of leaves; ovary 4–5 mm, ovoid, glabrous, green with white longitudinal markings. Fruit subglobose,  $\pm$  1.5 cm in diameter, glabrous, green with white longitudinal markings, smell unpleasant.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment hills in the *Acacia-Commiphora* scrub, trailing on shrubs and on ground. Localized in its distribution and reported to be common where it occurs. *Altitude:* 300–350 m. Distributed in the tropical regions of Africa, NW India, China, Australia. Not reported elsewhere in the Arabian Peninsula but expected to occur in SE Yemen.

*Distribution map:* Fig. 214. *Illustration:* Plate 152.

### 6. *Mukia* Arn.

4 species, distributed in the Old World tropics.

*Mukia maderaspatana* (L.) M.J. Roem., Syn. Monogr. 2: 47 (1846).

*Synonyms:* *Cucumis maderaspatana* L. (1753); *Bryonia cordifolia* L. (1753).

*Description:* Monoecious. Perennial herbs with scrambling stems, patent-hispid; tendrils simple. Leaves ovate in outline, 30–45(–60)  $\times$  25–30(–50) mm, 3-lobed, base sagittate-cordate, margin dentate, scabrid; lobes ovate, the central lobe largest. Flowers yellow, about 5 mm across, in crowded axillary heads. Fruit in axillary clusters, globose  $\pm$  9 mm in diameter, glabrous, smooth and shiny, dark red when mature.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, on the escarpment hills in the *Acacia-Commiphora* shrubland, trailing on shrubs and on the ground. Common. *Altitude:* 300–350 m. Distributed in the Old World tropics from W Africa to New Guinea and Australia. Not reported elsewhere in the Arabian Peninsula.

*Distribution map:* Fig. 215. *Illustration:* Plate 153



## 7. Luffa Mill.

6 species, mainly in the Old World tropics; 2 species cultivated throughout the tropics and of doubtful origin.

*Luffa acutangla* (L.) Roxb., Fl. Ind. 3: 713 (1832).

*Synonyms*: *Cucumis acutangla* L. (1753).

*vernacular names*: lufa; misi, isi (Jibbālī).

*Description*: Monoecious. Annual herb with climbing or trailing stems up to 5 m; stems angled, cabrous at the ribs, tendrils 5(–6)-fid. Leaves entire or palmately shallowly 5-lobed, 3–5 × 3–5 cm, base cordate, lobes somewhat sinuate, margins entire but with minute teeth, scabrid; petiole 2–1.5 cm. Flowers yellow, about 4 cm across; pedicels 3–4 cm; sepals and petals on a cup-shaped structure on the receptacle; male flowers in long axillary racemes; sepals 5–6 mm, 5-lobed, lobes lanceolate, acute; petals ± 2 cm, broadly obovate; stamens 5 (appearing as 3); female flowers solitary in the axils of leaves, petals slightly larger than in the male flower; ovary 10-ribbed, glabrous. Fruit 10–40 × 5–11 cm, ellipsoid to cylindrical, 10-ribbed, dry and fibrous, eventually opening at the apex, green, turning yellow-brown when dry, dehiscing by an opening at the top.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Southern Oman, Dhofar, on the wet escarpment hills, trailing on the ground and climbing on shrubs and trees. Generally found in shaded places. Common.

*Altitude*: 150–500 m. Native of India and Pakistan, introduced and cultivated throughout the tropical regions of the world. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 216. *Illustration*: Plates 154, 155

## Cultivated species

*Momordica charantia* L. (1753)

Monoecious, annual herb with trailing stems and simple tendrils. Leaves palmately 5–9-lobed. Flowers yellow with free petals. Fruits 10–25 cm, covered with short and long tubercles. The bitter melon, “kerula” (Hindi) is native of Asia, and is cultivated and eaten throughout Asia. It is cultivated in small farms on the Batnah and Salalah and sold at local markets.

## 31. Salicaceae

### Bibliography

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### Salix L.

About 400 species, distributed in cold and temperate regions.

*Salix acmophylla* Boiss., Diagn. Pl. Orient. ser. 1, 1(7): 98 (1846).

*Synonyms*: *Salix persica* Boiss. (1846).

*Vernacular names*: sawja, sawjar, sojar.

*Description:* Dioecious. Small tree or large shrub, up to 5 m. Young branches reddish-brown. Leaves 8–13 × 1–3 cm, linear-lanceolate, glabrous, apex acute, base shortly cuneate, margin shallowly serrate; petiole up to 1.5 cm; stipules minute, soon falling. Flowers in catkins, 2–5 cm long; bracts ovate, densely villous on the margins; perianth absent, male flowers: stamens 4–5, filaments villous at the base; female flowers: ovary ± 1.5 mm, stipitate, glabrous, stigma 2-lobed; nectaries cup-shaped. Capsule 4–5 mm, ovoid, fruiting stipe ± 1 mm. Seeds plumose.

*Flowering and fruiting:* March–April.

*Distribution and habitat:* Northern Oman, in wadis, gorges, near and in water courses and by edges of permanent streams. *Altitude:* 150–1800 m. Distributed in SW and C Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 217. *Illustration:* Plate 156.

*Notes:* The status of this species, whether native or introduced is debatable. It is not common and is found in a few mountain wadis where it is always found growing near villages. In present day Oman the plant is not used for any purpose. See comments in Miller & Cope (1996) on the distribution and relationships of this species.

## 32. Capparaceae

### *Bibliography*

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### Key to the genera of Capparaceae in Oman

- A. Fruit a winged nutlet, indehiscent. Gynophore absent. . . . . 7. *Dipterygium*
- A\*. Fruit un-winged, dehiscent or an indehiscent capsule or nut. Gynophore present
  - B. Annual or perennial herbs or subshrubs
    - C. Leafy herbs or subshrubs, not spinescent. Leaves ovate to 3- or 5-foliolate. Capsule elongated, glandular or pubescent but without large stalked glands. . . . . 6. *Cleome*
    - C\*. Virgate shrubs with stems ending in spines. Leaves linear-obovate, falling soon. Capsule subglobose, with large stalked glands, persisting for a long time on the plant. . . . . 5. *Dhofaria*
  - B\*. Trees or shrubs
    - D. Leaves with paired stipular thorns. Climbing shrubs. . . . . 4. *Capparis*
    - D\*. Leaves without stipular thorns. Non-climbing
      - E. Stamens borne on an androphore. Fruit cylindrical
        - E. Flowers zygomorphic (bilaterally symmetrical). Stamens 4–5 . . . 3. *Cadaba*
        - E\*. Flowers actinomorphic (radially symmetrical). Stamens many. . . 1. *Maerua*
      - E\*. Stamens not borne on an androphore. Fruit ovoid. . . . . 2. *Boscia*



1. **Maerua** Forssk.

About 80 species, distributed in the drier areas of the Old World, mainly Africa.

- A. Leaves 10–20×5–11 mm, obovate to obovate-oblong. Fruit cylindrical, torulose, green when mature .....1. **M. crassifolia**
- A\*. Leaves 20–70×5–12 mm, narrowly oblong. Fruit irregularly constricted in between the seeds, red when mature .....2. **M. oblongifolia**

1. **Maerua crassifolia** Forssk., Fl. Aegypt.-Arab. 103 & 104 (1775).  
*Synonyms:* *Maerua uniflora* Vahl (1790), nom. illegit.; *M. arabica* [F. Gmel.] (1791).  
*Vernacular names:* sahr.

*Description:* Tree or large shrub, evergreen, up to 7 m, with a single trunk and a flat-topped crown. Leaves simple, in clusters at the end of short shoots, or solitary on new shoots, 10–20×5–11 mm, obovate to obovate-oblong, apex rounded to retuse, base rounded to emarginate, glabrous, lamina somewhat thick and fleshy, petioles  $\pm$  2 mm, pubescent. Flowers 1–4 on short shoots; sepals 4, 5–7 mm, oblong-ovate, concave, greenish-yellow, pubescent; petals absent; stamens numerous, borne on a short androphore, stamens fully exerted at maturity; ovary borne on a gynophore; gynophore 10–20 mm long. Fruit 10–50 mm, cylindrical, torulose, green when mature.

*Flowering and fruiting:* February to March; September to October.

*Distribution and habitat:* Throughout Oman, on gravel plains, wadi fans, and on rocky slopes in the foothills of the mountains. Found in *Acacia-Euphorbia* shrubland in the foothills of the northern mountains, and in the *Acacia-Commiphora* shrubland in the south. Common. *Altitude:* 10–1500 m. Distributed in tropical and NE Africa, Palestine, Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 218. *Illustration:* Plates 157, 158.

*Notes:* Easily recognized in the field by its flowers which have long exerted stamens and ovary on a gynophore, and by the butterflies (caper white) and honey bees that are attracted to them during the flowering season. Oman plants have pubescent petioles and sepals but the leaves are glabrous. Extensively browsed by goats and camels. The name of this species is based on material collected from Yemen (N) by P. Forsskal (holotype C).

2. **Maerua oblongifolia** (Forssk.) A. Rich., Tent. Fl. Abyss. 1: 32, t. 6 (1847).

*Synonyms:* *Capparis oblongifolia* Forssk. (1775)

*Description:* Straggling or climbing shrub, evergreen, up to 3 m. Leaves simple, 20–70×5–12 mm, narrowly oblong, apex acute to obtuse, base rounded; petioles 5–10 mm. Flowers in axillary or terminal racemes; sepals 4, 8–10 mm, oblong-ovate, margins puberulous, green; petals white or yellow-green, stamens numerous, borne on a short androphore; ovary borne on a gynophore; gynophore 15–20 mm long. Fruit 20–40 mm, irregularly constricted in between the seeds, red when mature.

*Flowering and fruiting:* February to March.

*Distribution and habitat:* N Oman, in the foothills of the eastern Hajar mountains, on sandy and rocky hill slopes. *Altitude:* 50–300 m. Distributed in tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 219

*Notes:* I have seen only a single collection from the eastern Hajar range of the northern mountains. The name of this species is based on material collected from Yemen (N) by P. Forsskål (holotype C, isotype BM).

## 2. *Boscia* Lam.

37 species, distributed in the drier regions of tropical Africa and Arabia.

*Boscia arabica* Pestalozzi, Bull. Herb. Boiss. 6, app. 3: 127 (1898).

*Vernacular names:* sīr (Jibbālī); sīmer (Zufari Arabic).

*Description:* Small evergreen tree, up to 5 m, with a dense, flat-topped crown. Bark smooth, grey. Leaves simple, alternate, appearing spiral, or in clusters, 8–30 × 3–12 mm, obovate, apex rounded to retuse, base rounded to cuneate; glabrous to pubescent. Flowers pink, in axillary panicles; sepals 4, 3–4 mm, reflexed at anthesis; petals absent, stamens 6–8, exserted, not borne on an androphore. Ovary on a gynophore; gynophore 5–7 mm long. Fruit 5–8 mm, ovoid, green at maturity.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, on the lower altitudes and the seaward facing slopes of the escarpment mountains, with *Acacia* and *Commiphora*. *Altitude:* 200–1200 m. A regional endemic, occurring in Yemen and Dhofar.

*Distribution map:* Fig. 220. *Illustration:* Plates 159, 160.

*Notes:* Though the tree is not uncommon in Dhofar, several trees are recorded to be damaged and regeneration is not evident in several populations. The species is distributed at the foot of the escarpment mountains where it is partially vulnerable to felling and damage by camels. Careful monitoring of the trees is necessary for the conservation of this species.

## 3. *Cadaba* Forssk.

30 species, distributed in the Old World tropics, especially Africa.

### A. Fruit glandular

B. Leaves densely stellate-hairy, green. Petals white . . . . . 1. *C. heterotricha*

B\*. Leaves farinose, grey green, not stellate-hairy. Petals bright yellow . . . . . 3. *C. baccarinii*

A\*. Fruit farinose, not glandular. [Flowers yellow-green] . . . . . 2. *C. farinosa*

1. *Cadaba heterotricha* Stocks ex Hook. in Hooker's Icon. Pl. ser. 2, 9: t. 839 (1852).

*Description:* Shrub to a small tree, up to 5 m. Leaves alternate, simple, 10–35 × 7–20 mm, obovate to orbicular, apex obtuse or retuse, base rounded, densely stellate hairy, sometimes hairs glandular. Flowers white, zygomorphic, in terminal corymbose racemes; sepals 4,  $\pm$  7 mm; petals 6–8 mm, broadly-ovate, clawed, white; stamens 5, filaments adnate to the base of the gynophore, exserted; ovary on a 10–15 mm long gynophore. Fruits 22–25 mm, cylindrical, densely stellate-hairy and glandular, glands sessile.

*Flowering and fruiting:* February to April, September.

*Distribution and habitat:* Throughout Oman, on rocky slopes, cliffs and gravel plains, with *Acacia* and *Commiphora*. *Altitude:* 50–1400 m. Distributed in E. and NE Africa, Pakistan and India. Elsewhere in the Arabian Peninsula found in Yemen.

*Distribution map:* Fig. 221. *Illustration:* Plate 161.



2. *Cadaba farinosa* Forssk., Fl. Aegypt.-Arab. 68 (1775).

*Vernacular names*: simer (Jibbāli).

*Description*: Shrub, up to 2 m. Young twigs with whitish scales, becoming glabrous with age. Leaves alternate, simple, 5–30 × 3–20 mm, oblong-ovate to elliptic-oblong, farinose, apex obtuse, base rounded, grey-green. Flowers zygomorphic, yellow-green, solitary or in few-flowered racemes; sepals 4, 8–10 mm, concave; petals 10–15 mm, linear-elliptic, clawed; stamens 4–5; ovary on a 10–15 mm long gynophore. Fruits 25–55 mm, cylindrical, torulose, farinose.

*Flowering and fruiting*: September to October.

*Distribution and habitat*: Throughout Oman, on rocky slopes and on gravel plains, in dry scrub, and woodland with *Acacia* and *Commiphora*. *Altitude*: 0–1200 m. Distributed in Egypt, tropical Africa, Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 222. *Illustration*: Plates 162, 163.

*Notes*: The name of this species is based on material collected from Yemen (N) by P. Forsskal (holotype C, isotype BM).

3. *Cadaba baccarinii* Chiov., Ann. Bot. (Rome) 13: 377 (1915).

*Description*: Low woody shrub, up to 1 (–2) m. Leaves alternate, simple, 5–25 × 2–8 mm, obovate to oblong, apex obtuse or acute, base rounded, farinose. Flowers bright yellow, 1–3 at the tips of branches; sepals 4, 7–10 mm; petals 10–14 mm, ovate, clawed; stamens 4, exserted; ovary on a long gynophore. Fruits 10–17 mm, cylindrical, papillose-glandular.

*Flowering and fruiting*: September to January.

*Distribution and habitat*: Southern Oman, Dhofar, on the foothills of the escarpment mountains, and in the dry coastal areas, with *Acacia* and *Commiphora*. *Altitude*: 10–150 m. Distributed in Somalia. Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 223. *Illustration*: Plate 164.

*Notes*: In the Arabian Peninsula the species occurs only in Oman and probably in SE Yemen. It is heavily grazed by livestock.

4. *Capparis* L.

About 250 species, distributed in the tropics and subtropics of the Old and New Worlds.

A. Leaves oblong to lanceolate, falling soon (caducous). Flowers usually orange or red. . . . . 1. *C. decidua*

A\*. Leaves ovate or ovate-orbicular, not caducous. Flower white to pink

B. Petals up to 25 mm, the upper pair free, not cohering . . . . . 2. *C. spinosa*

B\*. Petals up to 4 cm, the upper pair cohering . . . . . 3. *C. cartilaginea*

1. *Capparis decidua* (Forssk.) Edgew., J. Linn. Soc. Bot. 6: 184 (1862).

*Synonymy*: *Sedalia decidua* Forssk. (1775); *Capparis aphylla* Roth. (1821).

*Vernacular names*: agul.

*Description*: Scrambling shrub, up to 4 m. Branches leafless for most part of the year, becoming spiny with age. Leaves falling soon, 4–20 × 1–3 mm, oblong to lanceolate, sparsely

pubescent, plicate. Flowers showy, 1–2 cm across, usually orange-red (yellow or white also known to occur), on long peduncles on short lateral branches; pedicel 14–15 mm; sepals 4, petaloid, the lower  $\pm$  10 mm, the upper two 10–11  $\times$  6–7 mm, joined together to form a hood enclosing the upper two petals; petals 4,  $\pm$  12 mm, the upper two  $\pm$  10 mm, connate; stamens 8–20, exserted; ovary borne on a 10–15 mm long gynophore. Fruit 10–15 mm in diameter, globose, pubescent, deep red when ripe.

*Flowering and fruiting*: December to April.

*Distribution and habitat*: Northern Oman, on the Batnah coast, on the edges of cultivated and irrigated land. *Altitude*: 0–150 m. Distributed in N and tropical Africa, Palestine eastwards to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Socotra.

*Distribution map*: Fig. 224.

*Notes*: Uncommon in Oman, and so far recorded only from the Batnah. More distribution data is needed to assess the status of this species. The wood is hard and is reported to be resistant to white ants. The name of this species is based on material collected from Yemen by P. Forsskål (holotype C).

## 2. *Capparis spinosa* L., Sp. Pl. 503 (1753).

(Including *Capparis mucronifolia* Boiss., Diagn. Pl. Orient. ser. 1, 4: 5 (1843)).

*Synonyms*: *C. leucophylla* DC. (1824); *C. spinosa* L. var. *egyptia* (Lam.) Boiss. (1867).

*Vernacular names*: lişaf, laşaf.

*Description*: Scrambling shrub, up to 1 m, with small hooked spines. Leaves 10–35  $\times$  4–17 mm, ovate to ovate-lanceolate, apex acute, base rounded, margin entire, lamina thick and somewhat fleshy, glabrous. Flowers white, showy, solitary, in the axils of leaves, pedicels 2–6 cm; sepals 4, unequal, 10–20 mm; petals 4, 7–25 mm, white becoming pink; stamens 8–20, exserted; ovary borne on a 20–30 mm long gynophore. Fruit 40–60 mm, obovoid, opening by valves which are reflexed at maturity exposing a red pulp. Seeds many.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Throughout Oman, including Halaniyah Island, on the foothills and hill slopes of the mountains, in crevices of cliffs and rocks, and on gravelly wadi beds. *Altitude*: 0–2000 m. Distributed in Africa, S Europe eastwards to C. Asia and India. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 225. *Illustration*: Plate 165.

*Notes*: A polymorphic species, variable in leaf characters. Two varieties are recognised, *C. spinosa* var. *spinosa* and *C. spinosa* var. *mucronifolia* (Boiss.) Hedge and Lammond (1970) (syn. *C. mucronifolia* Boiss., 1843), which differ from each other in the size of their leaves. In var. *mucronifolia* the leaves are 10–35 mm, more than twice as long as broad, with an acute apex, and in var. *spinosa* the leaves are less than twice broad and have a rounded to retuse apex. Material from Oman is very variable and difficult to place in either of the two varieties, and therefore, I have included var. *mucronifolia* under the type variety.

## 3. *Capparis cartilaginea* Decne., Ann. Sci. Nat. Bot. ser. 2, 3: 273 (1835).

*Vernacular names*: al belib (Jibbālī), aşelīb (fruit), aşlūb (fruit) haşelōr (Jibbālī), haşelīb (Jibbālī), lezāf, lişaf, lozef; qanfar (eastern Hajar region).



*Description:* Shrub with straggling or scrambling stems, spiny. Leaves 2–6×2–6 cm, ovate to orbicular, somewhat fleshy, apex emarginate with a spine below the apex, lamina thick and somewhat fleshy. Flowers solitary; pedicels 3–8 cm; sepals 1–4 cm, unequal, the upper hooded, petals white, up to 4 cm, ovary orbicular, the upper pair cohering, stamens many exerted. Fruit 3–5×2–3 cm, ellipsoid to oblong, red, many-seeded; seeds embedded in pulp.

*Flowering and fruiting:* March to May.

*Distribution and habitat:* Throughout Oman, including Musandam and Halamiyah Island, on the foothills of the mountains, on rocky slopes and cliff faces, growing from crevices and often hanging from cliffs. *Altitude:* 0–2000 m. Distributed from tropical N and E and SW Africa to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Socotra.

*Distribution map:* Fig. 226. *Illustration:* Plates 166, 167.

*Notes:* The fruit is sweet with a strong fruity smell when ripe. The ripe fruit is almost always full of maggots.

5. **Dhofaria** A.G. Miller  
1 species, endemic to SW Arabia.

*Dhofaria macleishii* A.G. Miller, Notes Royal Bot. Gard. Edinb. 45(1): 55–60 (1988).  
Type: Oman, Dhofar, E of Asqulomawt, 1600 m, 23 ix. 1984. *Miller* 6330 (holotype E, isotypes K, ON, UPS).

*Vernacular names:* herum idheri (Jibbālī).

*Description:* Dioecious shrub, up to 70 cm. Stems branched, virgate, spine-tipped, leafless for most of the year. Leaves alternate, linear-obovate, 4–15×1–2 mm, falling soon. Flowers in terminal and axillary racemes, sessile, ± 6 mm across, 4-merous; sepals unequal, densely stellate-triangular-ovoid, petals cream. Female flowers with the ovary on a gynophore, glandular. Capsule subglobose, 6–8 mm, dehiscent by 3–4-valves, covered with stiff glands, persisting on the stems throughout the year. Seeds embedded in an orange pulp.

*Flowering and fruiting:* September to December.

*Distribution and habitat:* Southern Oman, Dhofar, in the dry region north of the escarpment mountains and the south draining valleys of the escarpment woodlands. *Altitude:* 450–1600 m. A regional endemic, elsewhere in the Arabian Peninsula found in SE Yemen.

*Distribution map:* Fig. 227. *Illustration:* Plate 168.

*Notes:* The genus is endemic to SW Arabia, found only in the southern region of Oman and E Yemen. It is named after Ian McLeish, who has made important plant collections in Dhofar and who first collected the species in flower. The genus has no close relatives and may be considered a relict species.

6. **Cleome** L  
About 200 species, distributed in the tropical and subtropical regions.

(Key adapted from Chamberlain & Lamond (1996))

- A Stamens borne on an androphore. Gynophore present . . . . . 9. **C. gynandra**
- A\* Stamens not borne on an androphore. Gynophore absent

- B. Most leaves simple
  - C. Flowers actinomorphic (radially symmetrical).
    - D. Fruits narrow oblong, 0.5–1 mm broad, patent . . . . . 1. *C. scaposa*
    - D\*. Fruits oblong to elliptic, more than 1 mm broad, mostly erect
      - E. Fruits oblong, glandular, with small and large, stalked or sessile glands and with a long persistent style. Seeds densely pubescent . . . 4. *C. brevipetiolata*
      - E\*. Fruits elliptic, straight or slightly curved, glands sessile. Seeds minutely granulate . . . . . 5. *C. austroarabica*
  - C\*. Flowers zygomorphic (bilaterally symmetrical).
    - E. Stamens 4. Fruit patent to erect. Seeds minutely granulate or smooth and shining . . . . . 6. *C. noeana*
    - E\*. Stamens 6. Fruit pendulous. Seeds lanate when mature . . . . . 7. *C. rupicola*
- B\*. Most leaves compound, with 3 or more leaflets
  - G. Fruit pendulous, 30–40 mm, pubescent-glandular . . . . . 3. *C. amblyocarpa*
  - G\*. Fruit erect or patent, 4–12 mm, stipitate glandular, if up to 40 mm then fruit glabrous
    - H. Petals 1–4 mm, orange-yellow. Fruit glabrous. Seeds densely hairy . . . . . 8. *C. albescens*
    - H\*. Petals 3–8 mm, yellow with red markings, or with a median red stripe. Fruit stipitate-glandular. Seeds reticulate, glabrous . . . . . 2. *C. brachycarpa*

1. *Cleome scaposa* DC., Prodr. 1: 239 (1824).

*Synonyms:* *Cleome gracilis* Edgew. (1847).

*Description:* Annual herb, with a somewhat woody base. Stems 15–50 cm, branching from the base, erect, herbaceous, glandular-hispid. Leaves simple, 5–15 × 4–15 mm, broadly ovate to almost orbicular, apex acute, base rounded, leaves few above and decreasing in size upwards; petioles 2–25 mm; bracts linear to linear-lanceolate. Flowers actinomorphic, in lax terminal racemes; pedicels up to 12 mm in fruit; sepals 1–2 mm, ovate; petals pale yellow, 3–4 mm, obovate to elliptic; stamens 6, cohering around the style. Fruit 24–25 × 0.5–1 mm, narrow cylindrical, sparsely glandular, dehiscent by 3 valves from the base; fruit patent. Seeds minute, granulate, glabrous.

*Flowering and fruiting:* January to March.

*Distribution and habitat:* Throughout Oman, on rocky and sandy places, wadi beds and wadi fans, on hill slopes at lower altitudes, common by roadsides, and on waste and disturbed places. Common after rain. *Altitude:* 0–450 m. Distributed in N and tropical Africa, Pakistan. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 228. *Illustration:* Plate 169.

Notes: The species is based on material originating from Aden.

2. *Cleome brachycarpa* DC., Prodr. 1: 240 (1824).

*Description:* Perennial herb, with a woody base, strongly aromatic. Stems 10–30 cm, simple or branched, erect to ascending, stipitate-glandular. Leaves 3(–5)-foliolate, leaflets 4–15 × 1–7 mm, elliptic, apex acute, base rounded, glandular; petioles 2–28 mm; bracts similar to leaves. Flowers actinomorphic, in few-flowered terminal racemes; pedicels up to 15 mm; sepals ± 3 mm, ovate, with an acute apex; petals 3–8 mm, elliptic, yellow with reddish markings, or with



a median red stripe, stamens 6. Fruit 4–12 mm, oblong, stipitate-glandular, with a long persistent style. Seeds  $\pm$  1 mm in diameter, reticulate, glabrous.

*Flowering and fruiting*: April, May.

*Distribution and habitat*: Northern and central Oman, including Halaniyah Island, in gravel and sandy wadi beds. Not widespread but common at certain locations. *Altitude*: 50–250 m. Distributed in Egypt, tropical and NE Africa, S Iran to NW India. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen. Also found in Socotra.

*Distribution map*: Fig. 229. *Illustration*: Plate 170.

*Note*: The name of this species is based on material collected from Yemen (N) by P. Forsskal (holotype BM).

### 3. *Cleome amblyocarpa* Barr. & Murb., Acta Univ. Lund. n.s. Afl. 2, 1, 4: 25 (1905).

*Description*: Annual herb, very aromatic. Stems 10–80 cm, branched, erect. Leaves 3-foliate, the upper often simple; leaflets 5–30  $\times$  2–7 mm, elliptic, apex acute, base cuneate, pubescent; petioles 5–20 mm, bracts similar to leaves, the upper simple. Flowers zygomorphic, in few-flowered terminal racemes; pedicels up to 10 mm; sepals  $\pm$  2 mm, ovate; petals 3–4 mm, oblong to obovate, pale yellow with reddish markings; stamens 6. Fruit 30–40 mm, oblong, straight or curved, pendulous, pubescent-glandular. Seeds  $\pm$  2 mm in diameter, lanate when mature.

*Flowering and fruiting*: January to April.

*Distribution and habitat*: Northern and southern Oman, in moist places, sandy wadi beds and in disturbed and waste ground. *Altitude*: 20–100 m. Distributed in N Africa, Sudan, Ethiopia, Palestine, Iraq and Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 230.

### 4. *Cleome brevipetiolata* Chamberlain & Lamond, Edinb. J. Bot. 51(1): 49 (1994).

*Type*: Oman, Miller 6021 (holotype E, isotypes K, ON, UPS).

*Description*: Dwarf perennial. Stems up to 50 cm, branched, erect to ascending, glandular, glands sessile. Leaves simple, 3–8  $\times$  2–8 mm, broadly ovate to orbicular, apex subacute, base rounded, sparsely glandular; petiole 0–5 mm; bracts similar to leaves. Flowers actinomorphic, in few-flowered, lax, terminal racemes; pedicels up to 8 mm; sepals 1–5 mm, lanceolate; petals 3–6 mm, dimorphic, elliptic, yellow or yellow-green; stamens 4. Fruit 5–20  $\times$  2–5 mm, oblong, glandular, glands with short and long stalks or sessile; style long. Seeds  $\pm$  1 mm in diameter, densely pubescent.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Throughout Oman, including Hallaniyah Island, in sandy and stony deserts areas and stony wadis. More frequent in desert wadis in central Oman than in the foothills of the northern mountains. Not recorded from the Dhofar coastal plains or from the Batnah coast. *Altitude*: 50–600 m. Endemic to Oman.

*Distribution map*: Fig. 231.

*Notes:* The difference between this and the next species is not very distinct. The main difference is in the presence of sessile glands in *C. brevipetiolata* and stalked glands in *C. austroarabica*, and pubescent seeds in the former and minutely papillate seeds in the latter. The illustrations of the two species (Miller & Cope 1996: Fig. 69 [*C. brevipetiolata*] and Miller & Morris 1988: p. 95, figs 1A-111 [*C. austroarabica* as *C. droserifolia*]) are very similar in the presence of stalked and sessile glands throughout the plant and stipitate glandular fruits. The seed for *C. brevipetiolata* is illustrated as papillate rather than pubescent as described. Both species are part of the widely distributed and variable *C. droserifolia* species group (including other species with 4 stamens, distributed in Pakistan, Iran and Arabia), which is in need of a thorough revision.

5. *Cleome austroarabica* Chamberlain & Lamond, Edinb. J. Bot. 51(1): 51 (1994).

*Type:* Oman, Dhofar, Miller 6247 (holotype E, isotypes K, KTUH, ON, UPS).

*Description:* Dwarf perennial. Stems up to 1 m, branched, erect to ascending, stipitate glandular to glandular villous. Leaves simple, 8–20 × 8–15 mm, broadly ovate to orbicular, apex subacute, base rounded; petiole 7–20 mm; bracts similar to leaves. Flowers actinomorphic, in few-flowered, lax terminal racemes; pedicels 4–15 mm; sepals 3–5, lanceolate, petals 5–8 mm, dimorphic, lanceolate and narrow lanceolate, yellow with a median red stripe, stamens 4. Fruit 12–18 × 3–5 mm, elliptic to elliptic-oblong, straight or slightly curved, glandular with stalked and sessile glands. Seed ± 1 mm in diameter, minutely granulate.

A. Stems and leaves stipitate-glandular . . . . . 5a. *C. austroarabica* subsp. *austroarabica*

A\*. Stems and leaves glandular-villous . . . . . 5b. *C. austroarabica* subsp. *muscatensis*

5a. subsp. *austroarabica*

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, and Halamiyah Island on rocky and gravel places and rocky wadi beds. *Altitude:* 0–600 m. Endemic to SE Arabia, occurring in Dhofar and SE Yemen. Also found in Soqatra.

*Distribution map:* Fig. 232.

5b. subsp. *muscatensis* Chamberlain & Lamond, Edinb. J. Bot. 51(1): 51 (1994).

*Type:* Oman, Miller & Nyberg 9569 (holotype E, isotypes K, ON).

*Description:* Similar to *C. austroarabica* subsp. *austroarabica* and separated on the characters given in the key.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, on the foothills of the northern mountains, in rocky wadi beds. *Altitude:* 0–1500 m. Endemic to Oman, Saudi Arabia and the UAE.

*Distribution map:* Fig. 232. *Illustration:* Plates 171, 171a.

6. *Cleome nocana* Boiss., Diagn. Pl. Orient, ser. 2, 1: 48 (1853).

*Synonyms:* *C. drepanocarpa* Schwartz (1939).

*Description:* Annual or perennial herb or small shrub, strongly aromatic. Stems 15–60 cm, branched, glandular. Leaves simple, up to 40 × 40 mm, broadly ovate to orbicular, base rounded, with short glandular hairs, petioles 5–20 mm; bracts similar to leaves but smaller in size or absent in the upper part of the inflorescence axis. Flowers zygomorphic, in lax terminal



racemes; pedicels erect or patent, up to 15 mm; sepals 3–5 mm, ovate; petals 4–7 mm, dimorphic, two with lamina triangular and the other two with lamina lanceolate; petals yellow with a median red line; stamens 4. Fruit 15–30 mm, narrow oblong to linear, straight or slightly curved, glandular. Seed  $\pm$  1 mm in diameter, minutely granulate or smooth and shining.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Central and southern Oman, in wadi fans and stony wadis beds. *Altitude*: 0–700 m. Distributed in SW Asia (Iraq, Iran, Afghanistan, Pakistan) and C Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 233.

*Note*: A second race, *Cleome nycanum* subsp. *brachystyla* (Dollfus) Chamberlain & Lamond is distinguished by its shorter inflorescence, not overtopping the leaves, recorded from Saudi Arabia and Yemen, which may also occur in Dhofar.

7. *Cleome rupicola* Vicary, J. Asiat. Soc. Bengal 16: 1158 (1847).

*Synonyms*: *C. oxypetala* var. *micrantha* Boiss. (1867).

*Vernacular names*: muqabil as shams.

*Description*: Perennial herb, strongly aromatic, with a woody base. Stems 15–50 cm, branching from the base, erect, herbaceous and dying down after the growing season, glandular strigose. Leaves simple, 7–35  $\times$  3–27 mm, ovate to lanceolate, fleshy, apex acute, base rounded, strongly 3-nerved, axillary leaf bracts present, leaves decreasing in size upwards, glandular; petioles 2–28 mm; bracts linear to linear lanceolate. Flowers zygomorphic, in lax terminal racemes; pedicels up to 15 mm; sepals  $\pm$  2 mm, ovate, glandular; petals 5–9 mm, oblong-elliptic, orange-brown with dark red nerves; stamens 6. Fruit 20–51 mm, straight or slightly curved, pendulous, shortly stipitate, sparsely or densely glandular. Seeds  $\pm$  1.5 mm in diameter, lanate when mature.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern and Central Oman, in rocky gravel wadi beds. Often found growing beside roadsides. *Altitude*: 50–450 m. Distributed in SE Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map*: Fig. 234. *Illustration*: Plates 172, 173.

*Notes*: Apparently similar to *Cleome glaucescens* DC. and *C. oxypetala* Boiss., but distinguished by its glandular fruit.

8. *Cleome albescens* Franchet

subsp. *omanensis* Chamberlain & Lamond, Edinb. J. Bot. 51(1): 52 (1994).

*Type*: Oman, Miller & Nyberg 9029 (holotype E).

*Description*: Annual or perennial herb, glaucous. Stems 10–30 cm, simple or branched, stipitate-glandular. Leaves 3-foliate, leaflets 5–15  $\times$  1–7 mm, elliptic, apex acute, base rounded, sparsely glandular; petioles 2–12 mm; bracts similar to leaves, but smaller in size or absent. Flowers actinomorphic, in few-flowered terminal racemes; pedicels up to 10 mm; sepals 1–1.5 mm, ovate, glabrous; petals 1–4 mm, elliptic, orange-yellow; stamens 6. Fruit 10–40 mm, narrow-elliptic, glabrous. Seeds  $\pm$  1 mm in diameter, densely hairy.

*Flowering and fruiting*: ?September.

*Distribution and habitat:* Southern and central Oman, in the foothills of the mountains, in wadis and rocky areas. *Altitude:* 100–600 m. Elsewhere in the Arabian Peninsula distributed in eastern Yemen.

*Notes:* A regional endemic found in Oman and Yemen.

*Distribution map:* Fig. 235. *Illustration:* Plate 174.

9. *Cleome gynandra* L., Sp. Pl. 671 (1753).

*Synonyms:* *Cleome pentaphylla* L. (1753); *Gynandropsis pentaphylla* (L.) DC. (1824); *Gynandropsis gynandra* (L.) Briq. (1914).

*Description:* Annual herb, aromatic. Stems 30–70 cm, branched, erect, stipitate-glandular and villous. Leaves 3–5-foliolate; leaflets 13–70 × 6–33 mm, obovate, apex acute, base cuneate, glandular to glabrous; petioles 20–30 mm; bracts similar to leaves, the upper simple, the lower 3-foliolate. Flowers zygomorphic, in terminal racemes; pedicels 15–20 cm, sepals 2–4 mm, ovate; petals with lamina ± 5 mm in diameter, orbicular with a 5 mm long limb, white to pale mauve; stamens 6, borne on an androphore. Fruit 20–80–100 mm, linear, straight or curved, borne on a gynophore 5–12 mm long. Seed ± 1 mm in diameter, reticulate.

*Flowering and fruiting:* February to April; September to October.

*Distribution and habitat:* Throughout Oman, in cultivated fields and disturbed places. Weedy. *Altitude:* 0–1400 m. Pantropical. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map:* Fig. 236. *Illustration:* Plate 175.

7. *Dipterygium* Decne.

1 species distributed from Egypt to Pakistan.

*Dipterygium glaucum* Decne., Ann. Sci. Nat. Bot. ser. 2, 4: 67 (1835).

*Synonyms:* *D. glaucum* Decne. var. *macrocarpa* Blatter (1919–1936).

*Description:* Perennial woody herb or subshrub, 30–80 cm. Stems branching profusely, yellow-green, slender, glabrous, leafless for most of the year. Leaves simple, alternate, 2–20 × 1–6 mm, ovate, apex acute to obtuse; petioles 1–2 mm. Flowers in lax racemes; pedicels 1–2 mm, slender; sepals 4, ± 2 mm; petals 3–4 mm, pale yellow; stamens 6. Fruits 3–5 × 2–4 mm, elliptic, flattened, muricate, surrounded by a narrow wing, indehiscent.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Throughout Oman, on sandy and gravel plains, rocky slopes, and on disturbed and waste places. Often common beside roads. Common. *Altitude:* 0–500 m. Distributed in Egypt, NE Africa, Iran, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 237. *Illustration:* Plates 176–178.

*Notes:* One of the most commonly occurring plants in the plains, wadi fans and foothills in northern and central Oman. Less common in Dhofar. Grazed by livestock, but left alone if other palatable species are available. The name of this species is based on material collected from Saudi Arabia by Bove (P).



### 33. Brassicaceae (Cruciferae)

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Majority of the species in Brassicaceae in Oman are annuals which generally come up after rain. As with most desert annuals, if the seasonal rain is not sufficient, many of the annuals do not germinate, and consequently there may be only a single or two collections representing these species in herbaria. During the last decade, there has been an increase in trade between Iran and Oman across the Arabian Sea. This includes transport of sheep, which has brought several weedy species to Musandam, and consequently several weedy species are recorded only from the Musandam peninsula.

Indumentum (hairs) of leaves and stems is a useful character for the identification of the Arabian genera. Genera either lack hairs or the hairs are simple or stellate. Mature fruit is important for identification at generic and specific levels. A key to the Tribes of Brassicaceae, based on fruit and indumentum is provided for the genera found in Oman. I have followed I. Hedge & R.A. King (1983) and A.G. Miller (1996) for the treatment of the species of Brassicaceae found in Oman.

#### Key to the Tribes of Brassicaceae in Oman

See Miller & Cope 1996, Fig. 73, for illustrations of terms used in key)

- A. Fruit a siliqua (elongated terete capsular fruit that is at least 3 times as long as broad) or a silicula (broad capsular fruit that is less than 3 times as long as broad), usually dehiscent [except *Zilla*]
  - B. Fruit a siliqua
    - C. Siliqua beaked or divided into two segments, either both fertile or one sterile [except *Zilla*, *Sauvignya*]. Hairs simple or absent. Radicle incumbent I. BRASSICEAE
    - C\*. Siliqua not beaked or divided into two segments. Hairs always present
      - D. Stigma with or without decurrent carpinal lobes; sepals erect
        - E. Radicle accumbent (lying along the cotyledons). . . . . V. MATHIOLEAE
        - E\*. Radicle incumbent (resting on one side of the cotyledons) VI. HESPERIDEAE
      - D\*. Stigma capitate or lobed. Sepals spreading . . . . . VII. SISYMBRIEAE
  - B\*. Fruit a silicula
    - E. Fruit latiseptate (fruits compressed parallel to the septum or scarcely compressed). Hairs branched, stellate or simple . . . . . IV. ALYSSEAE
    - E\*. Fruit angustiseptate (fruits compressed at right angles to the septum). Hairs simple or absent . . . . . III. LEPIDAEAE

A\*. Fruit nut-like, indehiscent or tardily dehiscent .....III. EUCLIDEAE

### Key to the genera in Tribes

#### I. Tribe BRASSICEAE

- A. Plant with spiny branches. Fruit globose with a conical beak, indehiscent ..... 8. *Zilla*
- A\*. Plants not spiny. Fruits not as above
- B. Fruit a strongly compressed silicula with a short beak, shortly stipitate below  
.....10. *Savignya*
- B\*. Fruits not compressed
- C. Perennial herbs, glaucous, glabrous. Leaves fleshy, upper leaves amplexicaul
- D. Fruit 2-membered, upper segment globose with a conical beak, lower segment sterile and inconspicuous, indehiscent .....9. *Physorhynchus*
- D\*. Fruit 1-membered, linear, dehiscent .....11. *Moricandia*
- C\*. Annual or perennial herbs, glabrous or with simple hairs, not glaucous. Leaves not fleshy
- E. Petals with distinct brown to purple venation
- F. Fruit 2-membered
- G. Upper member of fruit a fertile beak
- H. Upper member of fruit ovoid or rostrate, 4-seeded, lower segment cylindrical .....7. *Erucaria*
- H\*. Upper segment of fruit cylindric or torulose, lower segment stalk-like  
.....6. *Raphanus*
- G\*. Upper member of fruit a sterile compressed beak. ....5. *Eruca*
- F\*. Fruit 1-membered
- E\*. Petals without distinct darker venation
- I. Fruit 4-angled in cross section .....2. *Erucastrum*
- I\*. Fruit rounded in cross-section
- J. Valves of fruit with conspicuous nerves
- K. Upper part of fruit cylindrical with a conical beak. Valves 1-nerved  
.....1. *Brassica*
- K\*. Upper part of fruit with a long beak. Valves 3-7-nerved ...3. *Sinapis*
- J\*. Valves of fruit without nerves. Fruit linear, readily dehiscent  
.....4. *Diploaxis*

#### II. Tribe LEPIDEAE

- A. Fruit many-seeded, obcordate, compressed .....15. *Capsella*
- A\*. Fruit 1-2-seeded, cordate or bi-lobed
- B. Valves of fruit inflated or winged
- C. Fruit tipped with a long persistent style; valves inflated .....14. *Cardaria*
- C\*. Fruit without a long persistent style; valves winged or horned at tip  
.....12. *Lepidium*
- B\*. Valves of fruit not winged or inflated. Fruit wrinkled or finely tuberculate  
.....13. *Coronopus*



III. Tribe EUCLIDEAE

Fruit nut-like, with rounded apical auricles, not compressed, tardily dehiscent. Flowers sessile .....16. **Anastatica**

IV. Tribe ALYSSEAE

- A. Leaves forming a basal rosette. Petals deeply bi-fid .....18. **Erophila**
- A\*. Leaves not forming a basal rosette. Petals not bi-fid
  - B. Fruit linear-oblong to broadly oblong. Seeds broadly winged .....17. **Farsetia**
  - B\*. Fruit suborbicular. Seeds not winged .....19. **Clypeola**

V. Tribe MATHIOLEAE

- A. Hairs adpressed medifixed. Fruits with two apical horns, valves not septate within .....20. **Notoceras**
- A\*. Hairs stellate. Fruit tipped by the persistent style, without apical horns, valves transversely septate within .....21. **Morettia**

VI. Tribe HESPERIDEAE

- A. Hairs simple or branched. Fruit not constricted between the seeds ....22. **Malcolmia**
- A\*. Hairs stellate. Fruit constricted between the seeds .....23. **Eremobium**

VII. Tribe SISYMBRIAE

- A. Hairs simple or plant glabrous. Fruit erect .....24. **Sisymbrium**
- A\*. Hairs branched (in our species). Fruit deflexed .....25. **Arabidopsis**

Key to the genera of Brassicaceae in Oman

- A. Branched hairs present on at least some part of the plant
  - B. Fruit a siliqua (elongated capsular fruit that is at least 3 times as long as broad)
    - C. Fruit with 2-3 horns at the apex
      - D. Hairs adpressed, medifixed. Each valve of fruit terminating in a horn; valves not septate within .....20. **Notoceras**
      - D\*. Hairs stellate. Valves of fruit not as above, but short and of indurated stigmas; valves transversely septate within .....21. **Morettia**
    - C\*. Fruit without apical horns
      - E. Hairs entirely (or almost so) adpressed medifixed
        - E. Delicate annuals. Petals clear yellow. Fruits deflexed .....25. **Arabidopsis**
        - E\*. Annual or perennial herbs. Petals white, pink or mauve. Fruits erect to ascending 24. **Sisymbrium**
      - E\*. Hairs forked to stellate or branched
        - G. Fruit constricted between the seeds .....23. **Eremobium**
        - G\*. Fruit not constricted between the seeds .....22. **Malcolmia**
  - B\*. Fruit a silicula (broad capsular fruit that is less than 3 times as long as broad), rarely siliqua (present in some species of *Farsetia*)

- H. Fruit compressed
  - J. Fruit compressed at right angle to the septum (angustiseptate), obcordate, cordate or triangular; valves keeled . . . . . 15. *Capsella*
  - J\*. Fruits compressed parallel to the septum (latiseptate), shape not as above; valves not keeled
    - K. Leaves forming a basal rosette. Petals deeply bi-fid. Seeds not winged . . . . . 18. *Erophila*
    - K\*. Leaves not forming a basal rosette. Petals not bi-fid. Seeds broadly winged . . . . . 17. *Farsetia*
- H\*. Fruit not compressed, nut-like with rounded apical auricles, tardily dehiscent . . . . . 16. *Anastatica*
- A\*. Plants glabrous or with simple hairs
  - L. Plants spiny. [Fruit globose, tapering apically into a conical beak] . . . . . 8. *Zilla*
  - L\*. Plants not spiny
    - M. Fruit compressed at right angles to the septum (angustiseptate)
      - N. Fruit tipped with a long persistent style; valves of fruit inflated . . . 14. *Cardaria*
      - N\*. Fruit not tipped with a long persistent style; valves of fruit not inflated
        - O. Fruit wrinkled or finely tuberculate; valves not winged . . . . 13. *Coronopus*
        - O\*. Fruit smooth; valves winged . . . . . 12. *Lepidium*
    - M\*. Fruit compressed parallel to the septum (latiseptate)
      - P. Fruit shortly stipitate; fruiting pedicel 10–25 mm, capillary, spreading or reflexed . . . . . 10. *Savignya*
      - P\*. Fruit not as above; fruiting pedicel shorter, not capillary
        - Q. Cauline leaves amplexicaul, auriculate or sagitate
          - R. Flowers yellow . . . . . 1. *Brassica*
          - R\*. Flowers white, pink or mauve
            - S. Fruit a siliqua, 1-membered, dehiscent . . . . . 11. *Moricandia*
            - S\*. Fruit a silicula, 2-membered, upper segment of fruit subglobose with a conical beak, lower segment inconspicuous . . . . . 9. *Physorhynchus*
        - Q\*. Cauline leaves sessile to petiolate, not amplexicaul, sometimes absent
          - T. Petals with distinct purple or brown venation
            - U. Fruit 2-membered, with the upper member of fruit a fertile beak
              - V. Upper member of fruit ovoid or rostrate, 4-seeded, lower segment cylindrical . . . . . 7. *Erucaria*
              - V\*. Upper member of fruit cylindric or torulose, lower segment still, like . . . . . 6. *Raphanus*
            - U\*. Fruit 1-membered, with the upper member of fruit a sterile, compressed beak . . . . . 5. *Eruca*
          - T\*. Petals without darker venation
            - W. Fruit 4-angled in cross-section . . . . . 2. *Erucastrum*
            - W\*. Fruit round in cross-section
              - X. Valves of fruit with conspicuous veins
                - Y. Upper part of fruit cylindrical with a conical beak; valves 1-veined . . . . . 1. *Brassica*
                - Y\*. Upper part of fruit with a long beak; valves 3–7-veined . . . . . 3. *Sinapis*
              - X\*. Valves of fruit without veins. [Fruit linear, readily dehiscent] . . . . . 4. *Diploaxis*



## 1. *Brassica* L.

About 40 species, distributed in Europe and Asia. Several species grown as edible greens and for the oil producing seeds.

*Brassica tournefortii* Gouan, Ill. Observ. Bot. 44: t. 20A (1773).

*Description:* Annual herb. Stems erect, up to 70 cm, glabrous above, hispid below, hairs simple. Leaves forming a rosette at the base, 5–25(–35) × 2–5(–10) cm, lyrate-pinnatisect, with 10–12 pairs of lateral lobes; lobes irregularly serrate, base tapering into the petiole; Flowers 4-merous, in terminal racemes; sepals  $\pm$  2 mm; petals 5–6 mm, pale yellow; stamens 6. Fruit a silique, 2-jointed, glabrous, 50–60 × 2–3 mm, erect to ascending; upper joint cylindrical to torulose with a conical beak; valves of lower joint 1-nerved. Seeds 1–2.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in the foothills and plains, on sandy and gravelly soils. *Altitude:* 0–1800 m. Distributed in S and W Europe, N Africa and SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 238.

## Cultivated species

*Brassica juncea* (L.) Czernj. (1859).

*Synonyms:* *Sinapis juncea* L. (1753).

Indian mustard is cultivated and often found as an escape in cultivated and irrigated land. It is an annual herb with erect stems and entire to lyrate-pinnatisect lower leaves. Flowers bright yellow. Silique, 20–75 × 2–4 mm, erect, beaked. Found throughout Oman from 0–2000 m. A native of C Asia, now cultivated in Asia, Africa, N America and S Europe. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

*Brassica glauca* L. (1753) (cabbage, cauliflower), *B. rapa* L. (1753) (turnip), are cultivated seasonally on the Bahmah and sold at local markets. These are rarely found as escapes.

## 2. *Erucastrum* C. Presl.

About 18 species, distributed in Macaronesia, C and S Europe and the Mediterranean.

*Erucastrum arabicum* Fisch. & Mey, Index Sem. Hort. Bot. Petrop. 5: 35 (1838).

*Synonyms:* *Brassica schimperii* Boiss (1842); *Brassica arabica* (Fisch. & Mey.) Fiori (1912).

*Description:* Annual herb. Stems erect, up to 50 cm, glabrous above, retrorse-hispid below, hairs simple. Lower leaves up to 15 × 3 cm, lyrate-pinnatisect, lobes irregularly serrate-sinuate, base tapering into the petiole; upper leaves similar but smaller in size, sessile. Flowers 4-merous, in dense terminal racemes; sepals  $\pm$  2 mm; petals 3–5 mm, yellow; stamens 6. Fruit a silique, 20–40 × 1–2 mm, 4-angled in cross section, erect, ascending, beaked; beak seedless. Seeds  $\pm$  1 mm, smooth or finely granulate.

*Flowering and fruiting:* March–April.

*Distribution and habitat:* Northern Oman, as a weed of cultivated land and disturbed places. *Altitude:* 600–2000 m. Distributed in tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 239.

*Notes:* The name of this species is based on material collected from Saudi Arabia by Schimper 941 (syntype LE, isosyntypes K, W), and Fischer 189 (syntype LE, isosyntypes K).

### 3. *Sinapis* L.

10 species, distributed in Europe.

*Sinapis arvensis* L., Sp. Pl. 668 (1753).

*Description:* Annual herb. Stems branched, up to 60 cm, hispid, hairs simple. Lower leaves up to 20 cm, lyrate-pinnatisect, lobes irregularly serrate, upper leaves oblong-lanceolate. Flowers 4-merous, in 20–40-flowered racemes; sepals 4; petals 6–12 mm, yellow. Siliqua 2-jointed, 18–45 × 2–4 mm; lower joint subcylindrical, torulose with a membranous septum, glabrous or retrorse-hispid, 8–16-seeded; valves 3–7-nerved; upper joint with a long beak.

*Flowering and fruiting:* April to May.

*Distribution and habitat:* Northern Oman, Musandam, in cultivated fields, and on irrigated land, as a weed of cultivation. *Altitude:* 0–1200 m. Distributed in Europe, N Africa, SW and C Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 240.

*Notes:* The leaves are edible.

### 4. *Diplotaxis* DC.

27 species, distributed from Europe to NW India.

- |   |                    |
|---|--------------------|
| A. Stems hairy (rarely glabrous). Flowers yellow        | 1. <i>D. harra</i> |
| A*. Stems sparsely hairy. Flowers lilac to light purple | 2. <i>D. acris</i> |

1. *Diplotaxis harra* (Forssk.) Boiss., Fl. Orient. 1: 388 (1867).

*Synonymy:* *Sinapis harra* Forssk. (1775).

*Vernacular names:* ghashār, ghashor, khardal, khawshyān.

*Description:* Annual herb or annual with a woody stock. Stems erect, 6–30(–60) cm, branched, with long spreading hairs, hairs simple. Leaves 2–8 × 1–4 cm, variable in size and shape, ovate to obovate to broadly obovate, apex obtuse, base tapering into a short petiole, margins serrate to irregularly serrate to entire; upper leaves similar to lower ones, but smaller in size. Flowers 4-merous, in terminal racemes, mildly fragrant; sepals spreading; petals 6–10 mm, bright yellow. Siliqua 25–40 × 4 mm, linear, beaked, erect to spreading at maturity.

*Flowering and fruiting:* March to April; September to October.

*Distribution and habitat:* Throughout Oman, on sandy and rocky areas, beside roads and in gravelly wadi beds. Common after rain. *Altitude:* 50–1800 m. Distributed in N Africa and SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 241. *Illustration:* Plates 179, 180.

*Notes:* Miller & Cope (1996) record that at high altitudes some plants are glabrous.



2. *Diplotaxis acris* (Forssk.) Boiss., Fl. Orient. 1: 389 (1867).

Synonyms: *Hesperis acris* Forssk. (1775).

*Description:* Annual herb. Stems erect, 6–45 cm, branched, with few long spreading hairs, hairs simple. Leaves in a basal rosette, 3–10 × 1–4 cm, ovate-oblong to pinnatisect, apex obtuse, base tapering into a short petiole, margin serrate to irregularly serrate to entire, upper leaves similar to the lower leaves, but smaller in size. Flowers 4-merous, in terminal racemes, mildly fragrant; sepals spreading; petals  $\pm$  15 mm, lilac to light purple. Siliqua 20–50 × 3 mm, linear, beaked, erect.

*Flowering and fruiting:* May.

*Distribution and habitat:* Northern Oman, on the northern mountains, on rocky slopes, amongst rocks. *Altitude:*  $\pm$  1900 m. Distributed in Egypt, Palestine, Jordan, Iraq. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

*Distribution map:* Fig. 242.

*Notes:* This is not a common species and I have seen it only on the Saiq plateau in the Jebel al Akhdar range of the western Hajar mountains. Miller & Cope (1996) do not record it from Oman.

5. *Eruca* Miller

5 species, distributed in the Mediterranean region.

*Eruca sativa* Miller, Gard. Diet. ed. 8: 1 (1768).

Synonyms: *Eruca lativalvis* Boiss. (1867).

*Description:* Annual herb. Stems erect, up to 40 cm, glabrous to hispid, hairs simple. Leaves 15 (–30) cm, lyrate to pinnatisect, margins coarsely dentate. Flowers white or pale yellow, in racemes; inner sepals saccate; petals 15–20 mm, yellow with distinct brown veins. Siliqua 15–30 × 3–4 mm, flattened, glabrous or hispid dehiscent, valves 1-nerved; fruit beaked with the beak  $\pm$  4 mm long.

*Flowering and fruiting:* March to May.

*Distribution and habitat:* Northern Oman, on the Batinah, as a weed of cultivation. Common in farms and on irrigated land. *Altitude:* 50–75 m. Native of Europe, introduced and cultivated in N Africa, SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 243.

6. *Raphanus* L.

8 species, distributed in C and W Europe, Mediterranean to C Asia.

- A. Fruit ridged longitudinally, not inflated, constricted in between the seeds, beak long and slender, breaking into 1-seeded segments. Not cultivated . . . . . ***R. raphanistrum***
- A\*. Fruit not longitudinally ridged or inflated and not constricted in between the seeds. Cultivated . . . . . ***R. sativus***

***Raphanus raphanistrum* L., Sp. Pl. 669 (1753).**

*Description:* Annual herb, with a tuberous tap-root. Lower leaves 5–20 cm, variable in shape but generally lyrate-pinnatisect, lobed; upper leaves narrower, simple, sessile. Flowers about 15 mm across, white or yellow or pink, in many-flowered racemes. Siliqua 2-jointed; upper joint 20–50 mm, oblong, beaked, ridged longitudinally, not inflated, constricted in between the seeds and breaking into 1-seeded segments; lower joint inconspicuous.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern Oman, by roadsides and in cultivated areas. *Altitude:* 50–2000 m. Distributed in Europe, N Africa, SW and C Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, Yemen (N).

*Distribution map:* Fig. 244.

**Cultivated species**

*Raphanus sativus* L., Sp. Pl. 669 (1753).

*Vernacular names:* fejel.

The radish is an annual or biennial herb, with a white slender tuberous tap root up to 50 cm long. Lower leaves 5–20 cm, variable in shape but generally lyrate-pinnatisect, lobed, with a sub-orbicular terminal lobe. It is cultivated throughout Oman and occasionally found as an escape. The leaves are also used as salad.

**7. *Erucaria* Gaertn.**

9 species, distributed in the eastern Mediterranean, Arabia and Iran.

**1. *Erucaria hispanica* (L.) Druce, Bot. Exch. Club Soc. Brit. Isles 3: 418 (1914).**

*Synonyms:* *Sinapis hispanica* L. (1753).

*Description:* Annual herb. Stems erect, up to 60 cm, branching from the base, glabrous. Leaves somewhat fleshy, the basal leaves subrosulate, 1–2-pinnatisect, lobes linear. Flowers lilac to mauve, in 30–40-flowered racemes; petals 10–12 mm. Siliqua 2-jointed, 10–15 mm, abruptly narrowing at the tip into a filiform style; lower joint readily or tardily dehiscent.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, Musandam, on stony, silty and gravelly places. *Altitude:* 600–1200 m. Distributed in S Europe, N Africa, SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE.

*Distribution map:* Fig. 245.

*Notes:* So far only recorded from Musandam. Not common.

**2. *Erucaria* sp. A.**

*Description:* Annual or ?perennial herb. Stems ascending, 25–40 cm. Leaves long-pinnatifid-lyrate-pinnatifid, obovate in outline, lobes obovate to oblong, 5–15 × 4–8 mm, rounded, the margin entire or with a few shallow teeth. Petals white, pale blue or violet, 3–6 mm. Siliqua (immature) 10–12 mm, straight, erect and appressed to stem; lower segment, 5–6 mm, about 4-seeded; the upper segment 5–6 mm ± 1-seeded, narrowing gradually at the tip into a conical style.



*Flowering and fruiting*: April (fl.).

*Distribution and habitat*: Northern Oman, in shade of rocks and in date gardens. *Altitude*: 650–1800 m. Endemic to Oman.

*Distribution map*: Fig. 246. *Illustration*: Plate 181.

*Notes*: There are several collections of this distinct taxon from northern Oman, but none with mature fruit. Distinguished from other Arabian species of *Erucaria* by its smaller flowers, lyrate-pinnatifid leaves with broader leaves and distinct fruits.

## 8. *Zilla* Forssk.

2 species, distributed from N Africa to Arabia.

*Zilla spinosa* (L.) Prantl in Engl. & Prantl, Nat. Pflanzenfam. ed. 1, 3(2): 175 (1890).

*Synonymy*: *Bulias spinosa* L. (1769).

*Description*: Perennial shrub, up to 1 m. Stems erect, stems and branches spiny, leafless, glaucous, older branches becoming spiny at tips. Leaves up to 30×4 mm, few on the stems, oblong, margins entire or irregularly toothed; leaves falling soon; basal leaves lyrate pinnatifid, falling soon. Flowers, ascending, in few-flowered racemes; inner sepals saccate; petals 15–17 mm, purple to pink-blue with darker veins. Fruit (silicula) 5–10 mm in diameter, globose with a spiny beak, smooth or verrucose, woody when mature.

*Flowering and fruiting*: February to March.

*Distribution and habitat*: Northern Oman, Musandam, in sandy places. *Altitude*: ± 500 m. Distributed in N Africa, Syria, Palestine, Jordan, Iraq. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 247.

*Notes*: So far only recorded from Musandam. Not common.

## 9. *Physorhynchus* Hook.

2 species, distributed from S Iran to NW India.

*Physorhynchus chamaerapistrum* (Boiss.) Boiss. Fl. Or. 1: 403 (1867).

*Synonymy*: *Zilla chamaerapistrum* Boiss. (1842).

*Vernacular names*: khafi, khafij, khawfig, khawfij.

*Description*: Annual or a short-lived perennial herb, 70–100 cm, glaucous. Stems ascending to erect, branched. Leaves 3–8×2–5 cm, lower leaves ovate-oblong, petiolate, the upper oblong, sessile, amplexicaul; leaves thick and somewhat fleshy. Flowers about 20 mm across, purple, in 12–20-flowered, lax racemes; inner sepals somewhat saccate; petals 12–15 mm. Silicula 10–15 mm, 2-jointed, the upper segment subglobose with a conical beak, indehiscent.

*Flowering and fruiting*: March to May.

*Distribution and habitat*: Northern Oman, in the foothills of the mountains and gravel wadi beds, with *Acacia tortilis* and *Euphorbia hatica*. Common and coming up after winter rain. *Altitude*: 50–900 m. Distributed in S Iran, SW Pakistan, reaching westwards to Northern Oman and the hilly areas of the UAE. Elsewhere in the Arabian Peninsula found in the UAE.

*Distribution map*: Fig. 248. *Illustration*: Plates 182, 183.

### 10. **Savignya** DC.

2 species, distributed from Morocco to Afghanistan.

*Savignya parviflora* (Del.) Webb, Giorn. Bot. Ital. 2: 215 (1847).

*Synonyms*: *Lunaria parviflora* Del. (1812); *Savignya aegyptiaca* DC. (1821).

*Description*: Annual herb. Stems ascending to erect, branched, up to 40 cm stems, with simple or glandular hairs. Leaves  $2-5 \times 1-2$  cm, lower leaves obovate-oblong, margins dentate, upper leaves linear, margins entire. Flowers white to pink, in lax racemes; petals 3-5 mm. Fruit (silicula)  $7-12 \times 5-7$  mm, broadly elliptic, compressed, stipitate, dehiscent, septum membranous, fruit on a long slender pedicel, pendulous.

*Flowering and fruiting*: February to March/April.

*Distribution and habitat*: Northern Oman, Musandam area, on sandy and gravelly soils. *Altitude*: 50-500 m. Distributed in N Africa, SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 249.

### 11. **Moricandia** DC.

8 species, distributed from the Mediterranean to SW Pakistan.

*Moricandia sinaica* (Boiss.) Boiss., Fl. Or. 1: 386 (1867).

*Synonyms*: *Brassica sinaica* Boiss. (1842).

*Description*: Perennial herb with a woody base, glabrous, glaucous. Stems erect to ascending, up to 70 cm. Leaves fleshy,  $2-5 \times 2.5-4$  cm, obovate to ovate, lower leaves with a cuneate base, upper leaves amplexicaul, sessile. Flowers pink to violet; inner sepals saccate, petals 12-15 mm. Siliqua 50-70 mm, linear, compressed-cylindrical, ascending, dehiscent.

*Flowering and fruiting*: October to November.

*Distribution and habitat*: Southern Oman, Dhofar, in dry gravelly wadi beds and rocky areas. *Altitude*: 600-700 m. Distributed in Egypt, Iran, Pakistan (Baluchistan), Saudi Arabia, Yemen.

*Distribution map*: Fig. 250.

*Notes*: An uncommon species in Oman, found in the drier regions of Dhofar.

### 12. **Lepidium** L.

About 150 species, cosmopolitan in distribution, especially in temperate regions.

- A. Silicula overlapping, ovate to quadrangular, acutely winged or horned at the tip, notched at the apex ..... 1. *L. aucheri*
- A\*. Silicula not overlapping, elliptic to suborbicular, narrowly winged and notched at the apex ..... 2. *L. sativum*

1. *Lepidium aucheri* Boiss., Ann. Sci. Nat. Bot. ser. 2, 17: 195 (1842).

*Description*: Annual herb. Stems ascending to prostrate, up to 30 cm, branched, glabrous or with a few simple hairs. Leaves up to 10 cm, pinnately-lobed. Flowers white, in dense racemes; sepals not saccate; petals 1-2 mm; stamens 6. Fruiting racemes dense with the silicula over-



lapping; silicula  $2-3 \times 1-2$  mm long, ovate to quadrangular, acutely winged or horned at the tip, notched at the apex, stigma protruding in the notch but not exceeding the wings.

*Flowering and fruiting*: ?March.

*Distribution and habitat*: Northern Oman, on cultivated and irrigated land, date gardens and silty depressions. *Altitude*: 0–1200 m. Distributed in Egypt and SW Asia (excluding Turkey). Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia.

*Distribution map*: Fig. 251.

## 2. *Lepidium sativum* L., Sp. Pl. 644 (1753)

*Vernacular names*: rashād, rishād.

*Description*: Annual herb. Stems erect, up to 60 cm, branches, glabrous or provided with simple hairs. Lower leaves  $4-10 \times 2-3$  cm, pinnate to lyrate-pinnate, short-lived; upper leaves linear. Flowers about 3 mm, white or pink, in 20–30-flowered branched racemes; sepals not sacate; petals 2–3 mm; stamens 6. Silicula  $4-6 \times 4-5$  mm long, elliptic to suborbicular, narrowly winged and notched at the apex, stigma protruding in the notch but not exceeding the wings.

*Flowering and fruiting*: March to June.

*Distribution and habitat*: Northern Oman, Musandam, on cultivated and irrigated land. A weed of cultivation. *Altitude*:  $\pm$  100 m. Native to Egypt and W Asia, introduced and naturalized elsewhere or cultivated. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 252.

*Note*: Garden cress is widely cultivated in Oman, but it is also found as a weed of cultivated areas.

## 13. *Coronopus* L.

10 species, almost cosmopolitan in distribution.

*Coronopus didymus* (L.) Smith, Fl. Brit. 2: 691 (1804).

*Synonyms*: *Lepidium didymum* L. (1767)

*Description*: Annual herb. Stems diffusely branched, up to 40 cm, ascending to prostrate, puberulous with simple hairs. Basal leaves up to 3 cm, rosulate, pinnatisect; segments ovate to elliptic, serrate to entire. Flowers minute, in 30–60-flowered, dense racemes; sepals not sacate; petals 0.5 mm; stamens 2–4. Silicula  $1.5 \times 2.5$  mm, bi-lobed, finely reticulately rugose, indehiscent.

*Flowering and fruiting*: February, March

*Distribution and habitat*: Northern Oman, on cultivated and irrigated land, as a weed of cultivation. *Altitude*:  $\pm$  20 m. A cosmopolitan weed. Distributed in the warm regions of the world. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia.

*Distribution map*: Fig. 253

#### 14. *Cardaria* Desv.

A single species, distributed from S Europe to W Asia.

*Cardaria draba* (L.) Desv., J. Bot. Agric. 3: 163 (1815).

*Synonyms*: *Lepidium draba* L. (1753).

*Description*: Perennial herb. Stems erect, up to 60 cm, with appressed simple hairs. Leaves simple, 8–12 × 1–4 cm, basal leaves obovate to spatulate, petiolate; upper leaves sessile, amplexicaul, decreasing in size upwards, margins dentate to entire. Flowers white, in corymbose racemes; sepals not saccate; petals 3–4 mm. Silicula ± 5 × 3–4 mm, cordate, with reticulate veins, indehiscent.

Flowering and fruiting: March.

*Distribution and habitat*: Northern Oman, Musandam, on irrigated land. *Altitude*: 10–600 m. Throughout the warmer regions of the world, as a weed of cultivation. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

*Distribution map*: Fig. 254.

#### 15. *Capsella* Medikus

5 species, distributed in the warm temperate regions.

*Capsella bursa-pastoris* (L.) Medikus, Pfl.-Gatt.: 85 (1792).

*Description*: Annual herb. Stems erect, up to 40 cm, sparsely hairy with some forked and branched hairs. Basal leaves in a rosette, 2.5–6 × 1–2 cm, narrowly obovate, pinnatifid to dentate or entire, shortly petiolate; upper leaves smaller, oblong to ovate, dentate to entire, base amplexicaul with acute auricles. Flowers in racemes; sepals not saccate; petals 2–2.5 mm, white. Silicula 5–10 × 4–6 mm, obcordate, laterally compressed, dehiscent, valves keeled.

Flowering and fruiting: February, March.

*Distribution and habitat*: Northern Oman, Musandam, on cultivated and disturbed ground. *Altitude*: ± 1100 m. Cosmopolitan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 255.

*Notes*: Uncommon in Oman, and perhaps under-collected.

#### 16. *Anastatica* L.

A single species, distributed from Morocco to S Iran.

*Anastatica hierochuntica* L., Sp. Pl. 641 (1753).

*Vernacular names*: khreysha, kiff al adhra, kiff e Maryam, shajaret al Maryam.

*Common English name*: Rose of Jericho.

*Description*: Annual herb. Stems up to 15 cm, prostrate to ascending, branching from the base, stellate hairy throughout. Branches hardening and rolled inwards when the plant is dry. Leaves grey-green, 3–4 × 2 cm, obovate to oblanceolate, shortly petiolate, margins entire or dentate. Flowers sessile, about 2 mm across, white, in the axils of leaves. Silicula ± 5 mm in diameter, ovoid-globose, stellate-hairy, 2-valved, with an apical auricle on each valve; style 2–3 mm, persistent.



*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in dry, sandy and silty wadi basins and wadi beds. Common after rain. *Altitude:* 20–600 m. Distributed from N Africa east to Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 256. *Illustration:* Plates 184, 185.

*Notes:* The plant is more noticeable when it is dry because of its curled-up branches, somewhat resembling a clenched fist. The dried stems unfurl when soaked in water. There are many folk legends attached to this plant: it is believed that Mary clenched this plant in her hand when giving birth to Jesus, hence the common Arabic name, “fist of Mary”. An infusion made from stems has been used for easing childbirth in traditional Arabian medicine.

17. **Farsetia** L.

About 20 species, distributed from Morocco to NW India, and the African mountains.

For the species found in Oman, I have followed B. Jonsell, *A monograph of Farsetia* (Acta Universit. Ups. Symb. Bot. Ups. 25(3): 1–105), and Miller & Cope (1996).

- A. Fruit broadly-oblong, 5 mm or more broad. Sepals 10–12 mm . . . . .1. **F. aegyptia**
- A\*. Fruit narrow-oblong to ovate-oblong, less than 5 mm broad. Sepals less than 10 mm
  - B. Leaves ovate to ovate-elliptic (4–20 mm broad). Petiole winged . . . . .2. **F. latifolia**
  - B\*. Leaves linear to linear-oblong (1–5.5 mm broad). Petiole not winged
    - C. Leaves somewhat fleshy. Fruit ovate to oblong, up to 14 mm long . . . . .**F. dhofarica**
    - C\*. Leaves not fleshy. Fruit narrow-oblong, up to 60 mm long
      - D. Fruit septum transparent
        - E. Sepals 3–4.5 (–5) mm. Delicate annual herb or woody based perennial . . . . .3. **F. stylosa**
        - E\*. Sepals 5–10 mm. Woody based herbs or subshrubs
          - F. Fruit narrow-oblong, 20–50×3–5 mm. Fruiting style usually more than 1 mm long . . . . .5. **F. longisiliqua**
          - F\*. Fruit narrow to elliptic-oblong, 15–20×1–3 mm. Fruiting style usually less than 1 mm . . . . .6. **F. heliophila**
        - D\*. Fruit septum opaque
          - G. Fruiting style usually more than 1 mm. Stigma globose . . . . .4. **F. linearis**
          - G\*. Fruiting style usually less than 1 mm. Stigma decurrent . . . . .6. **F. heliophila**

1. *Farsetia aegyptia* Luria, *Farsetia*: 5 (1765).  
*Synonyms:* *Lunaria scarina* Forssk. (1775); *Farsetia ovalis* Boiss. (1849).  
*Vernacular names:* libab masharri.

*Description.* Subshrub or a woody based perennial herb. Stems branched, 30–100 cm, stems grey-green, densely pubescent, hairs medifixed. Leaves 10–60×1–3 mm, linear to linear-elliptic-obtuse, base cuneate into the petiole, margins entire. Flowers dull-orange, ascending, in few-flowered racemes; sepals 10–12 mm, not saccate; petals 17–20 mm, white to grey-violet, clawed, truncate or emarginate at apex; stamens 6; stigmas decurrent. Siliqua 16–25×6–8 mm, compressed, oblong-elliptic, dehiscent with a membranous septum. Seeds winged.

*Flowering and fruiting:* March–April.

*Distribution and habitat:* Northern Oman, in the mountains and foot hills of the Hajar mountains, on hill slopes, amongst rocks and stones. Common. *Altitude:* 500–2000 m. Distributed in N. Africa, Sinai, Jordan, Syria, Iraq, Afghanistan, Pakistan. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE.

*Distribution map:* Fig. 257. *Illustration:* Plates 186, 187.

2. *Farsetia latifolia* Jonsell & A.G. Miller, Symb. Bot. Upsal. 25(3): 57 (1986).

*Type:* Oman, Dhofar, Thamrait-Salalah rd., Lx. 79, Miller 2404 (holotype E, isotype UPS).

*Description:* Annual to a perennial herb, with a woody base. Stems erect, up to 50 cm, densely pubescent with medifixed hairs. Leaves 10–45 × 4–20 mm, ovate to oblong-elliptic or broadly obovate, obtuse, base cuneate into a winged petiole, margins entire. Racemes 5–15-flowered, elongating up to 20 cm in fruit; pedicels in flower 1–2 mm, 3–7 mm in fruit; sepals 4–6 mm, not saccate; petals pale pink to pink-purple, 8.5–11 mm; stamens 6. Siliqua 20–48 × 1.5–2.7 mm, narrowly oblong, dehiscent, septum opaque. Seeds winged.

*Flowering and fruiting:* September.

*Distribution and habitat:* Southern Oman, Dhofar, occurring on open rocky or sandy places in the *Euphorbia balsamifera* shrubland, and in the *Bowallia sacra* open bushland. *Altitude:* 0–1200 m. Endemic to Oman and SE Yemen.

*Distribution map:* Fig. 258.

*Notes:* A regional endemic, and possibly also found in Saudi Arabia.

3. *Farsetia stylosa* R. Br. in Denham & Clapp., Narr. travels Africa app. 216 (1826).

*Synonyms:* *Farsetia hamiltonii* Royle (1834); *F. prostrata* (Steud.) Hochst. (1848); *F. nummularia* Fourn. (1864).

*Vernacular names:* gharegha, hashān.

*Description:* Annual or perennial herb sometimes with a woody base. Stems branched, ascending, 20–60 cm, densely pubescent with medifixed hairs. Leaves 10–60 × 0.5–5 mm, linear, obtuse, base cuneate into a short petiole, margin entire. Racemes 10–15-flowered, elongating to 40 cm in fruit; sepals 3–4 mm, not saccate; petals 4–7 mm, white to pale yellow, or mauve, with a rounded apex; stamens 6; stigma capitate. Siliqua 7–30 × 3–5 mm, narrow oblong, dehiscent, septum translucent. Seeds winged.

*Flowering and fruiting:* March, April.

*Distribution and habitat:* Northern Oman, in sandy depressions, and on dry rocky slopes in the foothills and wadis. Also found in the upper altitudes of the northern mountains. Common. *Altitude:* 30–1800 m. Distributed in tropical and NE Africa, Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Socotra.

*Distribution map:* Fig. 259.

*Notes:* A widespread and common species.



4. *Farsetia linearis* Decne. ex Boiss., Ann. Sci. Nat. Bot. ser. 2, 17: 150 (1842).

*Type*: Oman, Aucher-Eloy 4069 (syntypes BM, FI, K, P).

*Synonyms*: *Cheiranthus linearis* Forssk. (1775).

*Description*: Perennial herb with a woody base, or a subshrub. Stems branched, 15–70 cm, ascending, densely pubescent, hairs medifixed. Leaves 3–20 × 1–2 mm, linear to linear-obovate, acute, base cuneate into the petiole, margin entire. Racemes 10–15-flowered, elongating to 20 cm in fruit. Sepals 4–7 mm, not saccate; petals 6–10 mm, white to pale pink, fading to brown, apex rounded; stamens 6; stigma globose. Fruiting-style usually more than 1 mm long. Siliqua 20–40 × 1–2 mm, linear, dehiscent, septum opaque. Seeds winged.

*Flowering and fruiting*: March–April; September.

*Distribution and habitat*: Throughout Oman, in dry rocky areas, on stony slopes, and on gravelly and sandy desert places. *Altitude*: 20–2000 m. Endemic to the Arabian Peninsula, occurring in Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 260.

5. *Farsetia longisiliqua* Decne., Ann. Sci. Nat. Bot. ser. 2, 4: 69 (1835).

*Synonyms*: *Farsetia stylosa* (Steud.) T. Anders (1860), non R. Br. (1826).

*Description*: Perennial herb with a woody base, or subshrub. Stems branched, 30–100 cm, densely pubescent, hairs medifixed. Leaves 5–40 × 0.5–5 mm, linear, acute, base cuneate into the petiole, margin entire. Racemes 10–15-flowered, elongating to 30 cm in fruit. Sepals 6–10 mm, not saccate; petals 13–19 mm, pink to pale-yellow, fading to brown-purple, apex rounded; stamens 6; stigma decurrent. Fruiting-style usually more than 1 mm long. Siliqua 20–50 × 3–5 mm, narrow oblong, dehiscent, septum translucent. Seeds winged.

*Flowering and fruiting*: March to April; September.

*Distribution and habitat*: Throughout Oman, on dry rocky hill slopes, and on gravelly and sandy desert areas. *Altitude*: 20–2000 m. Distributed from Egypt to Somalia (borders of the Red Sea). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 261. *Illustration*: Plates 188, 189.

*Notes*. The name of this species is based on material collected by Bove from Yemen (K, P).

6. *Farsetia heliophila* Bunge ex Cosson, Ill. Fl. Atlant. 2: 227 (1884).

*Synonyms*: *Farsetia arabica* Boulos (1978).

*Description*: Subshrub or a woody based perennial herb. Stems branched, 30–100 cm, stems grey-green, densely pubescent, hairs medifixed. Leaves 10–60 × 1–3 mm, linear to linear-elliptic, obtuse, base cuneate into the petiole, margin entire. Flowers dull-orange, in few-flowered racemes, ascending; sepals 10–12 mm, not saccate; petals 17–20 mm, white to grey-violet, clawed with a truncate or a marginate apex; stamens 6; stigma decurrent. Silicula 16–25 × 6–8 mm, compressed, oblong-elliptic, dehiscent, septum membranous, opaque or translucent. Seeds winged.

*Flowering and fruiting*: March to April.

*Distribution and habitat:* Northern Oman, Musandam, on rocky slopes in the drier areas. *Altitude:* 0–50 m. Distributed in Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 262.

*Notes:* Similar to *Farsetia latifolia* but can be separated by its narrower leaves.

7. *Farsetia dhofarica* Jonsell & A.G. Miller, Symb. Bot. Uppsal. 25(3): 98 (1986).

*Type:* Oman, Jazir coast, Popov 68/53 (holotype BM, isotype UPS).

*Vernacular names:* bāwīw (Ḥarsūsi).

*Description:* Herb or subshrub up to 30 cm. Stems erect, several arising from the base, densely pubescent, hairs medifixed. Leaves somewhat fleshy, 10–25 × 1–5 mm, linear to linear-elliptic, acuminate, base attenuate, margins entire. Racemes 10–15-flowered, in subumbels; pedicel stout, patent, 4–5 mm in fruit; sepals 2.5–3.8 mm, not saccate; petals white, 4–4.5 mm; stamens 6; stigma decurrent. Silicula 3.5–4.0 × 2–3 mm, narrowly ovate to oblong, deliscent, septum opaque. Seeds winged.

*Flowering and fruiting:* September.

*Distribution and habitat:* Central Oman, in sandy, desert and semi-desert areas. *Altitude:* 0–150 m. Elsewhere in the Arabian Peninsula found in SE Yemen.

*Distribution map:* Fig. 263.

*Notes:* A regional endemic with a somewhat disjunct distribution. In Oman it is restricted to the central desert (eastern Dhofar) and then it occurs in the Hadramaut in S Yemen. The Yemen plants have broader leaves and elongated inflorescence and are intermediate between this and *F. burtoniae*, which is distributed in northern Saudi Arabia and Iraq.

## 18. *Erophila* DC.

10 species, distributed in Europe, with 2 species in the Mediterranean.

*Erophila verna* (L.) Bess., Enum. Pl. 71 (1822).

*Synonyms:* *Draba verna* L. (1753).

*Description:* Short-lived annual herb. Stems erect to sub-erect, single to several, up to 5 cm, hairs branched or stellate. Leaves in a basal rosette, lanceolate to obovate to oblong, acute, entire to dentate, margin hairy. Racemes 10–20-flowered; sepals 1–2 mm, not saccate; petals 2–3 mm, white, deeply bi-fid; stamens 4–6. Silicula laterally compressed, 3–5 × 1.5–3 mm, oblong-elliptic, glabrous.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, Musandam, in shaded places on terrace walls. *Altitude:* 500–1000 m. Distributed in Europe, Asia and N Africa, introduced into Australia and temperate America. Not found elsewhere in the Arabian Peninsula.

*Distribution map:* Fig. 264.

*Notes:* Recorded only from the Musandam Peninsula on the Arabian Peninsula (Miller & Cope (1996). The species is a short-lived annual and is possibly under-collected in Oman.



19. *Clypeola* L.

8 species, distributed in the Mediterranean region.

- A. Fruit with a pale margin, glabrous or with simple hairs . . . . . 1. *C. jonthlaspi*  
 A\*. Fruit without a pale margin, densely covered with stiff, minutely barbulate hairs  
 . . . . . 2. *C. aspera*

1. *Clypeola jonthlaspi* L., Sp. Pl. 652 (1753).

*Description:* Delicate annual herb. Stems up to 10 cm, simple or branched, hairs stellate. Leaves 3–10 × 1–2 mm, sessile, lanceolate to narrow obovate, acute, base tapering. Racemes 25–50-flowered, lax; sepals ± 1 mm; petals ± 1.5 mm, yellow to white; stamens 6, filaments toothed. Silicula pendulous, 4–5 mm in diameter, suborbicular, with a pale margin, emarginate, glabrous or with simple hairs.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern Oman, in the mountains, on sandy and stony places and limestone rocks. *Altitude:* ± 1920 m. Distributed in S Europe, N Africa, SW and C Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 265.

*Notes:* Not common but perhaps under-collected. Very similar to *Clypeola aspera* but distinguished by its fruit which is glabrous or with short simple hairs.

2. *Clypeola aspera* (Grauer) Turrill, J. Bot. 60: 269 (1922).

*Description:* Delicate annual herb. Stems up to 20 cm, simple or branched, hairs stellate. Leaves 5–20 × 1–3 mm, sessile, lanceolate to spatulate, acute, base tapering. Racemes 20–50-flowered, lax; sepals ± 1 mm; petals ± 1.5 mm, yellow to white; stamens 6, filaments toothed. Siliqua pendulous, 3.5–4.5 mm in diameter, suborbicular, without a pale margin, emarginate, densely covered with stiff, minutely barbulate hairs.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern Oman, Musandam, in the mountains, and on sandy and stony wadi banks. *Altitude:* 1850–1900 m. Distributed in SW and C Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

*Distribution map:* Fig. 266.

*Notes:* Recorded by Miller & Cope (1996) to be less common than *Clypeola jonthlaspi*.

20. *Notoceras* R. Br.

2 species, distributed in the Canaries, Mediterranean region, including Europe to NW India.

*Notoceras bicornis* (Aiton f.) Amo, Fl. Fan. Penins. Iberica 6: 536 (1835).

*Synonyms:* *Notoceras canariensis* R. Br. (1812).

*Description:* Annual herb. Stems grey-green, ascending to prostrate, up to 20 cm, branched from the base, adpressed pubescent, hairs medifixed. Leaves 5–50 × 2–6 mm, oblanceolate, acute, base attenuating into a short petiole. Flowers white, in short racemes; petals ± 2 mm. Siliqua 4–8 × 1–2 mm, cylindric, appressed to the stem, pubescent, valves ending in 2 horns at the apex.

*Flowering and fruiting:* April.

*Distribution and habitat:* Northern Oman, Musandam, on stony and rocky places. *Altitude:* 100–550 m. Distributed in SW Europe, N Africa, Syria to Pakistan (Punjab, Baluchistan) and Afghanistan. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 267.

## 21. **Morettia** DC.

4 species, distributed from N Africa to Arabia.

- A. Plants grey-green. Hairs on stems soft and dense .....1. **M. parviflora**  
 A\*. Plant yellow-green. Hairs on stems coarse .....2. **M. philacana**

### 1. **Morettia parviflora** Boiss., Ann. Sci. Nat. ser. 2, 17: 60 (1842).

*Vernacular names:* hafrāh.

*Description:* Annual herb. Stems canescent, grey-green, ascending up to 40 cm, branching from the base, densely pubescent, hairs soft, stellate. Leaves 1–4 × 1–2 cm, ovate to elliptic, acute, base attenuating into a short petiole, margins entire or with a few teeth. Flowers white, sepals 2–3 mm, not saccate; petals 4–5 mm. Siliqua 10–22 × 1–1.5 mm, curved, transversely septate, with the persistent indurated style and stigmas at the apex.

*Flowering and fruiting:* March to April.

*Distribution and habitat:* Northern Oman, in the foothills of the mountains, wadi fans, on sandy and gravel soils. Common annual especially after rain. *Altitude:* 20–1800 m. Distributed in Egypt, Sinai, Palestine and Jordan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 268. *Illustration:* Plates 190, 191.

### 2. **Morettia philacana** (Del.) DC., Syst. Nat. 2: 427 (1821); Boiss (1842).

*Synonyms:* *Sinapis philacana* Del.; *Morettia asperrima* Boiss. (1842).

*Description:* Similar to *Morettia parviflora*, but plant yellowish green, and with coarse scabrid, stellate hairs that come off if the plant is touched, larger sepals ( $\geq 7$  mm) and generally smaller siliqua (10–15 mm).

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman, in the foothills on sandy, gravelly locations and in wadi beds. *Altitude:* 50–650 m. Distributed in N and NE Africa south to Somalia. Not recorded elsewhere in the Arabian Peninsula, however Schwartz (1939) records it from Saudi Arabia. Less common in Oman than the previous species.

*Distribution map:* Fig. 269.



# 22. *Malcolmia* R.Br.

About 35 species, distributed from the Mediterranean to Afghanistan.

*Malcolmia africana* (L.) R. Br. in Aiton f., Hort. Kew. ed. 2, 4: 121 (1812).

*Synonyms*: *Hesperis africana* L. (1753); *Strigosella africana* (L.) Botsch. (1972).

*Description*: Annual herb. Stems erect, up to 40 cm, sparsely to densely tomentose, hairs branched. Leaves 2–8 × 1–3 mm, elliptic to oblong-elliptic to obovate, margins entire to dentate. Flowers pale pink to mauve, in lax racemes; sepals 3–6 mm, saccate or not; petals 6–10 mm; stigma lobes decurrent. Siliqua 4–7 cm, cylindric, often straight, densely tomentose.

*Flowering and fruiting*: April.

*Distribution and habitat*: Northern Oman, Musandam, on sandy wadi banks. *Altitude*: ± 850 m. Distributed in the Mediterranean region, SW Asia and N China. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE.

*Distribution map*: Fig. 270.

*Notes*: So far recorded only from Musandam.

# 23. *Eremobium* Boiss.

3 species, distributed from N Africa to Arabia.

*Eremobium aegyptiacum* (Spreng.) Aellen & Schweinf. ex Boiss. Fl. Or. Suppl. 30 (1888).

*Synonyms*: *Eremobium lineare* (Del.) Boiss. (1867); *Malcomia aegyptiaca* Spreng. (1825).

*Vernacular names*: rahad.

*Description*: Annual herb. Stems grey-green, decumbent to ascending, up to 30 cm, pubescent, hairs stellate. Leaves 4–40 × 1–3 mm, linear, obtuse, base tapering, margin entire. Racemes lax; sepals 3–4 mm, saccate; petals ± 8 mm, white to pink; stigma lobes decurrent. Siliqua 10–30 mm, linear, cylindrical or torulose, narrowing at the apex, ascending to patent, pubescent.

*Flowering and fruiting*: March to April.

*Distribution and habitat*: Northern Oman, Musandam, on gravelly and sandy desertic soils. *Altitude*: 20–1100 m. Distributed in N Africa, Palestine, Jordan, Iran, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 271.

*Notes*: Not common, but perhaps under-collected.

# 24. *Sisymbrium* L.

80 species, Eurasian in distribution; also distributed in S Africa and N America.

A. Fruit 30–45 mm, cylindrical, not narrowing at the top.

1. *S. irio*

A\*. Fruit 20–30 mm, narrowing at the top . . . . . 2. *S. crysimoides*

1. *Sisymbrium irio* L., Sp. pl. 659 (1753).

*Vernacular names*: shilat.

*Description*: Annual herb, 20–60 cm. Stems erect, 15–50 cm, sparsely pubescent to glabrescent, with simple hairs. Basal and lower leaves pinnately lobed, variable in size, 3–15 × 1–4 cm, hastate, upper leaves hastate. Flowers in many-flowered racemes, up to 30 cm long, ascending;

fruiting pedicel 3–10 mm, thinner than the fruit; sepals not saccate; petals yellow,  $\approx 3$  mm; Siliqua 30–45 mm, linear, not tapering at the top, glabrous, 20–30-seeded, ascending.

*Flowering and fruiting*: March to May.

*Distribution and habitat*: Throughout Oman, on cultivated and disturbed land. A weed of cultivation, common in date gardens and other irrigated places. *Altitude*: 0–1800 m. Distributed in SW and C Asia, Europe and N Africa. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map*: Fig. 272.

## 2. *Sisymbrium crysimoides* Desf., Fl. Atlant. 2: 84 (1798).

*Vernacular names*: maharraqa.

*Description*: Annual herb, 15–40 cm. Stems erect, 15–50 cm, sparsely pubescent to glabrescent, with simple hairs. Basal and lower leaves pinnately lobed, variable in size, 3–15  $\times$  1–4 cm, hastate; upper leaves similar to the lower leaves. Flowers in many-flowered racemes, up to 30 cm long, ascending; fruiting pedicels 1.5–4–5 mm, more or less as thick as the fruit, sepals not saccate; petals yellow-white, 1.5–2.5 mm. Siliqua 20–40 mm, linear, tapering at the top, glabrous, ascending.

*Flowering and fruiting*: March, April.

*Distribution and habitat*: Northern Oman, Musandam, on sandy and gravelly soils. *Altitude*: 300–550 m. Distributed in the Mediterranean region, Africa and SW Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen. Also found in Socotra.

*Distribution map*: Fig. 273.

*Notes*: So far recorded only from Musandam.

## 25. *Arabidopsis* Heynh.

13 species, distributed from the north temperate regions to the tropical African mountains.

*Arabidopsis pumila* (Stephan ex Willd.) N. Busch, Pl. Cauc.-Cauc. 3(4): 457 (1909).

*Description*: Annual herb. Stems erect up to 80–50 cm, simple or branched, pubescent, hairs simple or branched. Leaves in a basal rosette, 1–3(–10)  $\times$  0.3–0.6 cm, obovate, entire or pinnatifid; cauline leaves ovate, entire or toothed, sagittate at the base. Flowers in racemes; sepals not saccate; petals pale yellow. Siliqua 10–15  $\times$  1 mm, linear, deflexed, glabrous, dehiscent.

*Flowering and fruiting*: February to March.

*Distribution and habitat*: Northern Oman, Musandam, amongst rocks, on exposed mountain slopes. *Altitude*:  $\pm$  2040 m. Distributed in E Europe, SW and C Asia. Not found elsewhere in the Arabian Peninsula.

*Distribution map*: Fig. 274.

*Notes*: So far, recorded only from Musandam.



## 34. Moringaceae

*Bibliography*

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**Moringa** Adanson

14 species, distributed in Africa and Asia.

- A. Branches drooping, leafless for most of the year. Flowers pink. Native . . . ***M. peregrina***  
 A\*. Branches not drooping, leafy. Flowers white. Cultivated . . . . . ***M. oleifera***

*Moringa peregrina* (Forssk.) Fiori, *Agricult. Colon.* 5: 59 (1911).

*Synonyms:* *Hyperanthura peregrina* Louche (1775); *Moringa aptera* (Forssk.) Gaertn. (1791); *M. arabica* Pers. (1805).

*Vernacular names:* shu'; 'ash bēnch, terfāl, yēn (Jibbālī); oil: hal al shu'.

*Description:* Tree, up to 6 m. Branches drooping, bluish-green, leafless for most of the year. Leaves coming out at the beginning of the flowering season, 2–3-pinnate, alternate, up to 30 cm long; leaflets opposite, 10–20 mm, oblong. Flowers pink, in large axillary panicles, fragrant; sepals 5, spreading; petals 5, 8–10 mm, unequal, the outer largest, inner 2 smallest; stamens 5, alternating with small nectarines. Capsule 10–30 cm cylindrical, dehiscing by 3 valves.

*Flowering and fruiting:* February to May.

*Distribution and habitat:* Throughout Oman, in the foothills of the mountains, on rocky slopes amongst stones and in wadi beds. Often found growing from crevices on cliffs. *Altitude:* 50–1200 m. Distributed in NE tropical Africa, SW Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 275. *Illustration:* Plates 192–195.

*Notes:* Oil extracted from seeds is used in traditional medicine for ailments of the digestive system, childbirth and as skin lotion. The oil is sold in the local markets in Nizwa and Bahla and is known as 'wonder oil' because of its multiple uses.

*M. peregrina* is one the honey plants that bees use for making honey. Wild collected seed of this species is held at the Millennium Seed Bank, Royal Botanic Gardens, Kew, U.K.

**Cultivated species***Moringa oleifera* Lam

Tree up to 6 m, with leafy branches and sprays of white flowers. Cultivated for the edible capsules commonly cooked in curries. Common English name: Horse radish tree.

## 35. Resedaceae

*Bibliography*

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## Key to the genera of Resedaceae of Oman

- A. Usually leafless shrubs, with stems ending in spines. Leaves when present linear or reduced ..... 1. *Ochradenus*  
 A\*. Leafy herbs and subshrubs  
 B. Leaves linear (1–3 mm wide). Flowers unisexual. Petals 2. Capsule 4-toothed at the apex ..... 2. *Oligomeris*  
 B\*. Leaves ovate or variously lobed (more than 3 mm broad if entire). Flowers bisexual. Petals 4–6 or more. Capsule 3-toothed at the apex ..... 3. *Reseda*

1. *Ochradenus* Del.

6 species, distributed from the Middle East to Soqatra, Libya, Pakistan.

Key adapted from Miller & Cope (1996).

- A. Fruit oblong-ovoid, shortly pedicellate. Disc double, the inner part cup-shaped. Stamens 20 or more than 20  
 B. Anthers yellow. Seeds smooth and glossy ..... 5. *O. aucheri*  
 B\*. Anthers orange. Seeds finely tuberculate, not glossy ..... 4. *O. giffrii*  
 A\*. Fruit globose, sessile or shortly pedicellate. Disc single. Stamens 10–18  
 C. Leaves present, spatulate, in fascicles. Fruit 3–6-lobed in cross section ..... 3. *O. harsusiticus*  
 C\*. Leafless shrubs. Fruit not lobed in cross section  
 D. Fruit white (often drying red), not inflated or papery. Seeds minutely tuberculate ..... 1. *O. baccatus*  
 D\*. Fruit yellow or straw-coloured, inflated and papery. Seeds smooth and glossy ..... 2. *O. arabicus*

1. *Ochradenus baccatus* Delile, Fl. Aegypt. Illustr. 63 (1813).

*Synonymy*: *Ochradenus baccatus* var. *monstruosa* Muell. Arg. (1857); *O. baccatus* var. *sandawi* Hochst. & Steud. ex Muell.-Arg. (1857).

*Vernacular names*: 'asmat, 'aşmat, hibāb.

*Description*. Dioecious shrub, up to 1 m, leafless for most of year. Stems straggling, slender, leafless, older stems getting spinescent. Leaves 1–4 cm, linear, falling soon. Flowers yellow, unisexual, in lax or dense spikes, up to 20 cm; pedicel 1–2 mm; sepals 1–2 mm, oblong-ovate; petals absent (rarely present); stamens 10–18; disc reflexed or erect. Fruit 3–6 mm in diameter, globose to subglobose, somewhat inflated, white when mature. Seeds minutely tuberculate.



*Flowering and fruiting*: September to October.

*Distribution and habitat*: Southern Oman, Dhofar, in the drier areas of the escarpment mountains. *Altitude*: 10–1800 m. Distributed in SW Pakistan, Iran, Jordan, Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen. Also found in Soqatra.

*Distribution map*: Fig. 276. *Illustration*: Plates 196, 197.

2. *Ocbradenus arabicus* C. Bondurci, Hillcoat & Miller, Notes Royal Bot. Gard. Edinb. 41(3): 494 (1984).

*Vernacular names*: ʿaṣmat, ḥibāb kib (Eastern Hajar region), shākhas, shākhas.

*Description*: Dioecious leafless shrub, up to 1 m, stems and branches rigid, spreading, ending in spines. Leaves falling soon, sessile, 7–18 × 1–1.5 mm, linear-oblong, puberulous. Flowers yellow, unisexual, sessile, in terminal spikes; male flowers: sepals 5–6 mm, oblong-ovate; petals absent; stamens 12–16, with yellow filaments, arising eccentrically from a green disc; disc entire to undulate; female flowers: disc eccentrically surrounding the ovary; stamens absent. Capsule 4.5–5.5 × 4.5–6 mm, globose to ovoid, 10–18-seeded, green becoming yellow when mature. Seeds glossy, smooth.

*Flowering and fruiting*: December to April; September to October.

*Distribution and habitat*: Throughout Oman, on open gravelly, and rocky habitats. Occurring in the foothills and gravel wadi beds in northern Oman and in the drier areas of the escarpment mountains in Dhofar. *Altitude*: 50–800 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia, S Yemen. Also found in Soqatra.

*Distribution map*: Fig. 277. *Illustration*: Plates 198, 199.

*Notes*: The name of this species is based on material collected from UAE by J. Edmondson 3129 (holotype E).

3. *Ocbradenus harsusiticus* A.G. Miller, Notes Royal Bot. Gard. Edinb. 41(3): 497 (1984).

*Type*: Oman, Bwai, J.R. Mcconchie 3430 (holotype E, isotype ON).

*Vernacular names*: gürsüt (Harsūsi).

*Description*: Spiny shrub, up to 50 cm; branches intricate, ending in spines. Bark grey-white, somewhat flaking. Leaves in fascicles or on short lateral branches, falling soon; leaves 5–10 × 1–3 mm, spatulate, grey-green. Flowers bisexual, sessile, white to pale yellow, in few-flowered, lax spikes. Flowers  $\pm$  4 mm across; sepals 6, 1.5–2 mm, ovate to elliptic; petals 4,  $\pm$  2 mm, linear, white; disc entire, flat, pentagonal. Capsule 4–6 mm, ovoid, 3- or 6-lobed in transverse section, yellow when mature, inflated. Seeds smooth.

*Flowering and fruiting*: November to April.

*Distribution and habitat*: Central Oman, on the limestone plateau of the Jiddat al Harasīs, on sandy and gravelly soils. Common. *Altitude*:  $\pm$  150 m. Endemic and so far recorded only from there.

*Distribution map*: Fig. 278. *Illustration*: Plate 200.

4. *Ocbradenus giffrii* Thulin, Nordic J. Bot. 14: 383 (1994).

*Description*: Slender shrub, up to 2 m, with straight ascending branches, glabrous throughout. Leaves linear, 7–17 mm. Pedicel 2–5 mm. Flowers bisexual, in lax racemes 15–40 cm long;

pedicel 2–5 mm; sepals 6, 2–2.5 mm, oblong; petals 4, with an ovate appendage; disc double, cup-shaped, the inner part membranous, the outer fleshy; stamens  $\pm$  25. Capsule leathery, 2–3 mm, obovoid or subglobose, erect or ascending on a 4–5 mm pedicel. Seeds dark-brown to black, tuberculate.

*Flowering and fruiting*: September.

*Distribution and habitat*: Southern Oman, Dhofar, in the drier areas of the mountains and foothills, on open rocky slopes and wadi beds. *Altitude*: 50–1300. Elsewhere in the Arabian Peninsula found in SE Yemen.

*Distribution map*: Fig. 279. *Illustration*: Plate 201.

*Notes*: A regional endemic, occurring in Dhofar and eastern Yemen. Not common in Dhofar and known only from Wadi Afal and locations near Dhalqut. Both areas are under developmental pressure and there is concern to the existence of this species in Oman. The name of this species is based on material collected from Yemen (S) by M. Thulin et al. 8417 (holotype UPS, isotype K).

## 5. *Ochradenus aucheri* Boiss., Diagn. Pl. Or. ser. 2, 50 (1854).

*Synonyms*: *Homalodiscus aucheri* (Boiss.) Boiss. (1867).

*Description*: Annual or biennial woody herb, up to 1 m. Stems yellow-green, glabrous, leafless. Leaves falling soon, 1–5 cm, linear. Flowers bisexual, about 5 mm across yellow, in long spicate inflorescences 10–30 cm long; pedicel 1–2 mm; sepals 6, 1.5–2 mm, obovate; petals  $\pm$  8 mm, lanceolate, with 1–2 basal teeth; disc single or double, flat or cup-shaped. Capsule 10 $\times$ 7 mm, subglobose, erect, inflated, yellow-brown. Seeds glossy black, smooth.

*Flowering and fruiting*: February to April.

*Distribution and habitat*: Northern Oman and Musandam, in the foothills of the Hajar mountains, on open rocky places and gravelly wadi beds. *Altitude*: 50–1000 m. Elsewhere in the Arabian Peninsula found in the UAE.

*Distribution map*: Fig. 280. *Illustration*: Plate 202.

*Notes*: A regional endemic found in northern Oman in the foothills of the northern mountain range and extending into the UAE.

## 2. *Oligomeris* Cambess.

9 species, distributed from the Middle East to Pakistan and India, N and S Africa, SW USA.

### *Oligomeris linifolia* (Vahl.) J.E. Macbride, Contr. Gray Herb. n.s. 53: 13 (1918).

*Synonyms*: *Reseda linifolia* Vahl. (1815); *Oligomeris subulata* Webb (1854).

*Description*: Annual herb, 7–20 cm. Stems erect, glabrous, ribbed. Leaves sessile, 10–50 $\times$  1–3 mm, linear, in fascicles, glabrous. Flowers bisexual, subpedicellate, in long dense terminal spikes; sepals 4, 1–2 mm; petals 2, 1–2 mm, white, entire or lobed; stamens 3–4, inserted to one side of the flower opposite the petals. Capsule 3–4 mm in diameter, depressed globose, papery, erect, 4-toothed at the apex, opening by apical teeth.

*Flowering and fruiting*: February to April, after rain.

*Distribution and habitat*: Northern Oman, in the foothills and plains, wadi beds, runnels and sandy depressions. Common after rain. *Altitude*: 0–2000 m. Distributed from N Africa east to



India, westward to Spain, Canary Islands, SW USA. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 281.

3. *Reseda* L.

55 species, distributed in the Mediterranean region, C Asia.

- A. Leaves lobed. Plant papillose throughout
  - B. Flowers (6-)7(-8)-merous. Posterior petal 5-11-lobed. Seeds smooth .....1. *R. aucheri*
  - B\*. Flowers 6(-8)-merous. Posterior petal 7-9-lobed. Seeds tuberculate .....2. *R. muricata*
- A\*. Leaves not lobed. Plant glabrous, not papillose .....3. *R. sphenocleoides*

1. *Reseda aucheri* Boiss., Diagn. Pl. Or. Nov. ser. 1, (1): 5 (1843)  
var. *bracteata* (Boiss.) Abdallah & de Wit, Meded. Landb. 78(14): 167 (1978).

*Synonyms:* *Reseda bracteata* Boiss. (1845).  
*Vernacular names:* dinabān, zinbān.

*Description:* Annual herb, or sometimes a perennial herb, up to 30 cm. Stems erect, simple or branched, papillose throughout. Leaves 1-10×1-4 cm, lobed with obovate to lanceolate to ovate lobes, apex of lobes acute, margins undulate. Flowers (6-)7(-8)-merous, white to cream, in dense, terminal spikes; spikes up to 15 cm. Petals unequal; posterior petal 3-5 mm, 5-11-lobed; stamens 12 or more. Capsule 3-6 mm, ovoid, narrow at the apex with 3 small pointed teeth. Seeds shiny, smooth.

*Flowering and fruiting:* February to April.

*Distribution and habitat:* Northern Oman and Musandam, in the foothills of the Hajar mountains, in sandy and gravel habitats, wadi beds and irrigated places. Also present on Halaniyah Island. *Altitude:* 50-600 m. Distributed in Syria, Palestine, Iran to C. Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map:* Fig. 282. *Illustration:* Plate 203.

*Notes:* The species is very similar to *Reseda muricata* C. Presl., differing from it in its usually entire leaves and smooth seeds.

2. *Reseda muricata* C. Presl., Abh. Königl. Böhm. Ges. Wiss. ser. 5, 3: 438 (1845).  
*Vernacular names:* dinabān, zinbān.

*Description:* Perennial herb or a woody based annual. Stems erect to ascending, up to 40 cm, simple or branched, papillose throughout. Leaves 10-30, ternately lobed, lobes linear to linear-obovate, margins entire to undulate. Flowers 6(-8)-merous, white to cream, in dense, terminal spikes, spikes up to 14 cm. Posterior petal 2-3 mm, 7-9-lobed; stamens 10-16. Capsule 2-5 mm, ovoid, narrow at the apex with 3 small pointed lobes. Seeds shiny, tuberculate.

*Flowering and fruiting:* January to March.

*Distribution and habitat:* Northern Oman and Musandam, in the foothills of the Hajar mountains, on stony hill slopes, and gravel wadi beds. *Altitude:* 50-1000 m. Distributed in Egypt, Jordan, Palestine and Iraq. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

*Distribution map:* Fig. 283.

*Notes:* The leaves when crushed emit an unpleasant smell.

3. *Reseda sphenocleoides* Defl., Bull. Soc. Bot. France 42: 298 (1895).

Vernacular names: ‘umhamīr (Jibbālī).

*Description:* Perennial herb or subshrub. Stems erect, up to 45–120 m, glabrous throughout. Leaves fleshy, 3–10 × 1.5–5 cm, ovate to oblong elliptic, apex acute to obtuse, base tapering into a short petiole, margins entire. Flowers 6/–9/–merous, pale yellow to cream, in dense, conical, terminal spikes. Posterior petal 3–4 mm, 7–11-lobed, stamens 20 many. Capsule 7–12 × 3–4 mm, ovoid, narrow at the apex with 3 small pointed lobes. Seeds shiny, minutely tuberculate.

*Flowering and fruiting:* September to October.

*Distribution and habitat:* Southern Oman, Dhofar, in the plains and foothills of the mountains on dry rocky slopes, and in sandy habitats. *Altitude:* 50–1800 m. Endemic to SW Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map:* Fig. 284. *Illustration:* Plate 204.

*Notes:* Fresh plant is used in traditional medicine to treat snake bites and wounds in camels. The name of this species is based on material collected from Yemen by Defflers 530 (holotype P).

### 36. Sapotaceae

#### *Bibliography*

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 Friis, I. (1979). A reconsideration of the genera *Monotheca* and *Spiniluma*. *Kew Bull.* 33(1): 91–98.  
 Pennington, T.D. (1991). *The genera of the Sapotaceae*. Royal Botanic Gardens, Kew.

#### *Sideroxylon* L.

About 74 species, distributed mainly in the Neotropics, with about 25 species distributed in Africa, Madagascar, Mascarenes, Asia, NW Pakistan eastwards to Saudi Arabia and S Ethiopia.

The taxonomic rank of *Monotheca*, *Spiniluma* and *Sideroxylon* have been a subject of differing opinions and can only be sorted on what one accepts as the generic concept of *Sideroxylon*. Here, I have followed Pennington's (1991) concept of the genus *Sideroxylon* and the inclusion of the species in it. The status of the genera *Monotheca* and *Spiniluma*, as maintained by Pennington (1991) has no basis in the pantropical context. The habit of *Monotheca* is intermediate between *Spiniluma* and *Sideroxylon* s. str., that is, the plant is spiny but the leaves are not fasciated on short lateral shoots as in *Spiniluma* (see Friis 1979). The ruminant endosperm and unilocular ovary with 5 basal ovules on which *Monotheca* is separated also occur in species of *Sideroxylon*. The ruminant endosperm occurs in a Macaronesian species of *Sideroxylon* (*S. marmulano*) and the unilocular ovary with 5 basal ovules also occurs as a variant within *Sideroxylon* and other genera.



*Sideroxylon mascatense* (A. DC.) Penn. in G.E. Wickens, J.R. Goodin and D.V. Field (eds), *Plants for Arid Lands*, 273 (1985); Penn., *The genera of Sapotaceae*, 174 (1991).

*Type*: Mascat, Aucher-Eloy 4916 (lectotype G, islectotype K).

*Synonymy*: *Laportea buxifolia* Falc. (1842). Type described from Pakistan and Afghanistan; *Reptonia buxifolia* (Falc.) A. DC. (1844); *Monotheca mascatensis* A. DC. (1844). Type as for *Sideroxylon mascatensis*; *Monotheca buxifolia* (Falc.) A. DC. (1846); *Sideroxylon buxifolium* Hutch. (1931). Type: Somaliland, Surdud Range, Colenette 371 (K); *Reptonia mascatensis* (A. DC.) Radlk. ex O. Schwartz (1939); *Sideroxylon buxifolium*, non Hutch. (1931).

*Vernacular names*: būr.

*Description*: Small tree or large shrub, up to 2 m, bark grey, mealy, lateral branches ending in spines. Leaves alternate, 2–3.5 × 1–1.5 cm, oblong-ovate to spatulate, apex obtuse, base tapering into a short petiole; margins entire; leaves grey-green above, grey-sericeous beneath or glabrous. Flowers ± 3 mm, pale yellow, sessile, in axillary clusters; sepals 5-lobed, sericeous; petals 5-lobed; stamens borne on the corolla tube, exceeding the petals. Fruit (berry) ± 1.5 cm in diameter, globose with a short apical point, fleshy, 1-seeded, purple-black when ripe, edible.

*Flowering and fruiting*: April to June.

*Distribution and habitat*: Northern Oman, in the western and eastern Hajar mountains, forming open woodlands with *Olea europaea*. Above 2000 m it occurs with *Junipers excelsa* subsp. *polycarpus*. The species is also known from a single collection on the edge of Jebel Semhan in Dhofar occurring at 1800 m. *Altitude*: 1000–2500 m. Distributed from SW Pakistan, Afghanistan, southern Iran, Arabia to NE Africa (N Somalia, Ethiopia, Djibouti). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

*Distribution map*: Fig. 285. *Illustration*: Plates 205–207.

*Notes*: The būr trees form a major component of the woody vegetation of the northern mountains of Oman, associated with *Olea europaea*, *Dodonaea viscosa*, *Sageetia then* and other woody shrubs. The plant has been described by early Arab writers in the 9th century as a “mountain tree with edible berries, ripening black, that blacken the mouth of the eater”. The berries are collected by the local inhabitants and are also sold in markets. A variant of the species, locally called *bejint* bears yellow-brown fruits. This form is widespread in the Jebel Akhdhar range (western Hajar), Jebel Kaur (western Hajar) and the eastern Hajar range. It is well known and preferred for its better flavoured fruits. It is sympatric with the black-coloured fruit form and flowers and fruits at the same time, from April to June.

### 37. Ebenaceae

#### *Bibliography*

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**Euclea L.**

12 species, distributed from tropical Africa to Arabia, and Comoro Islands.

***Euclea racemosa*** Murr., Syst. Veg. Ed. XIII: 747 (1774)

subsp. ***schimperi*** (A. DC.) E. White, Bull. Jard. Bot. Natn. Belg. 50(3-4): 99 (1980).

**Synonyms:** *Euclea schimperi* (A. DC.) Dandy (1950). For full synonymy see Friis (1992).

**Vernacular names:** Kilit, kilit, qilit (Zufari Arabic, Jibbālī).

**Description:** Dioecious. Evergreen shrub or small tree, up to 4 m. Bark grey-black. Leaves alternate to subopposite, 35–70 × 10–20 mm, narrow-obovate, apex obtuse, base tapering into a short petiole, margins entire, undulate; leaves dark glossy-green above, pale dull-green beneath. Flowers creamy-white, in pendant axillary racemes. Pedicel ± 1 mm; sepals 1.5–2 mm, 4-lobed; male flowers larger than the female flowers with obovate petals fused below, stamens about 15; female flowers with petals ± 3 mm, fused below, ovary on a fimbriate disc. Fruit (berry) globose, 5–7 mm in diameter, glabrous or sparsely pubescent, black when ripe, 1-seeded.

**Flowering and fruiting:** April to June.

**Distribution and habitat:** Southern Arabia, Dhofar, on the wet escarpment mountains and grassland, with *Anogeissus dbojatica* and other woodland shrubs. Common. **Altitude:** 200–750 m. Distributed in S and E Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

**Distribution map:** Fig. 286. **Illustration:** Plate 208.

**Notes:** The ripe fruits are edible. For details on uses of this species see Miller & Morris (1988).

### 38. Primulaceae

#### *Bibliography*

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#### Key to the genera of Primulaceae in Oman

- A. Annual herbs. Flowers solitary or in racemes, blue, red or white  
 B. Leaves opposite and decussate, not forming a basal rosette. Flowers blue, red or white ..... 1. *Anagallis*  
 B\*. Leaves forming a basal rosette, cauline leaves alternate. Flowers white ..... 2. *Samolus*  
 A\*. Perennial herbs. Flowers in umbellate cymes, yellow ..... 3. *Dionysia*

#### 1. *Anagallis* L.

About 20 species, distributed in Europe, African mountains and S America.

- A. Leaves ovate to ovate-oblong. Flowers blue or red ..... 1. *A. arvensis*  
 A\*. Leaves narrow oblong. Flowers white ..... 2. *A. pumila*



1. *Anagallis arvensis* L., Sp. Pl. 148 (1753).

*Synonyms:* *Anagallis latifolia* L. (1753).

*Vernacular names:* 'aynah, 'ayn al qaṭ, (a)zraig al 'ayn, (a)zērkah.

*Description:* Annual herb, up to 10 cm. Stems branched, erect to ascending, glabrous. Leaves sessile, opposite and decussate, 10–15 × 7–10 mm, ovate to ovate-oblong, gland-dotted. Flowers deep blue with a red centre, solitary, axillary, on slender pedicels; pedicels recurved in fruit; sepals 3–4 mm, lanceolate; petals 5–6 mm, obovate, margin with glandular hairs. Fruit globose.

*Flowering and fruiting:* February to April; September.

*Distribution and habitat:* Northern and southern Oman, in cultivated and irrigated places.

*Altitude:* 0–2000 m. Cosmopolitan in the temperate regions. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

*Distribution map:* Fig. 287. *Illustration:* Plates 209, 210.

*Notes:* All Oman specimens examined so far are blue-flowered and belong to *A. arvensis* var. *caerulea* (L.) Gouan.

2. *Anagallis pumila* Sw., Prodr. Veg. Occ. 40 (1783).

*Description:* Annual herb, up to 15 cm. Stems sparsely branched, erect to ascending, glabrous. Leaves sessile, opposite and decussate, narrow oblong. Flowers white, solitary, axillary, on slender pedicels; pedicels recurved in fruit.

*Flowering and fruiting:* ?September.

*Distribution and habitat:* Southern Oman, Dhofar, in the wet escarpment mountains, amongst rocks. *Altitude:* ± 700 m. Distributed in Egypt. Not recorded elsewhere in the Arabian Peninsula, but expected to occur in SE Yemen.

*Distribution map:* Fig. 288. *Illustration:* Plate 211.

*Notes:* This record is based on a single collection and photograph by S. Collenette from Dhofar, which possibly belongs to this species. I have not seen any authentic material from Oman. More collections are needed to confirm the identity of this species.

2. *Samolus* L.

15 species, cosmopolitan in distribution, especially in saline soils.

*Samolus valerandi* L., Sp. Pl. 443 (1753).

*Description:* Annual herb up to 15 cm. Stems and branches ascending, glabrous. Leaves glabrous, forming a basal rosette, cauline leaves alternate. Leaves 10–12 × 4–5 mm, obovate, apex obtuse, base tapering into a short petiole, margin entire. Flowers white, ± 2 mm across, in axillary and terminal racemes. Bracts lanceolate; sepals ± 1.5 mm, 5-lobed, lobes obtuse; petals broadly tubular, 5-lobed above.

*Flowering and fruiting:* September, after monsoon.

*Distribution and habitat:* Southern Oman, Dhofar, on the wet escarpment woodlands, on moist and shaded places, and near streams. The plants come up after the monsoons. Not common.

*Altitude*: 600–850 m. Distributed in the Mediterranean region, Balkans, Turkey, Pakistan to China. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

*Distribution map*: Fig. 289.

### 3. *Dionysia* Fenzl.

About 42 species, distributed in C Asia, Iran, Afghanistan.

*Dionysia mira* Wendelbo, Bot. Not. 112: 500 (1959).

*Type*: [Oman], Mascate, *Aucher-Eloy* 5236 (syntypes G, K, P).

*Synonyms*: *Primula aucheri* Jaub. & Spach. *Type*: Same as above.

*Vernacular names*: shajārat al wa'al.

*Description*: Perennial herb, forming large clumps, up to 60 cm across. Stems pubescent, erect to ascending or decumbent, up to 25 cm, somewhat woody at the base. Base of stems covered with remains of old leaves. Leaves 30–80 × 6–19 mm, yellow-green above, creamy farinaceous beneath, white-pubescent, emitting an odour when crushed, oblanceolate to spatulate, apex obtuse, base tapering into a winged petiole, margin sinuate-dentate, nerves distinct beneath. Bracts foliaceous, pale-green, 12–25 × 5–7 mm, margin entire to dentate or serrate. Flowers in umbellate cymes, yellow; peduncle 6–15 mm, pubescent. Pedicel 5–7 mm, enlarging to ± 20 mm in fruit; calyx 10–11 mm, tubular, 5-lobed, lobes acute; corolla tubular, 5-lobed above; tube ± 15 mm, pubescent on the outside, lobes 3–4 mm. Capsule 3–4 mm, ovoid.

*Flowering and fruiting*: February to May, but also flowering at other times.

*Distribution and habitat*: Northern Oman, in the western and eastern Hajar mountains, on rocky slopes, under rock overhangs, in the *Olea-Juniperus* woodland. *Altitude*: 1600–2800 m. Endemic to Oman.

*Distribution map*: Fig. 290. *Illustration*: Plates 212, 213.

*Notes*: Endemic to the northern mountains of Oman. More widespread and common in the western Hajar, but with localized distribution. This is an attractive plant with horticultural potential, and at some risk from becoming threatened through collection of whole plants by amateur collectors.



## Families with only cultivated species

### Caricaceae

#### *Carica papaya* L.

*Vernacular names:* faty, pawpaw.

Dioecious, herbaceous tree, up to 3 m with an unbranched trunk, covered with scars of fallen leaves. Leaves 30–60 cm, deeply divided into several lobes which are lobed again. Fruit 20–30 × 10–15 cm (or larger or smaller), subglobose or pyriform, yellow or green when ripe with an orange flesh. *Flowering and fruiting:* September, October, but more or less also throughout the year.

A native of tropical America, cultivated in the tropical and subtropical countries of the world. Cultivated commercially in Oman mainly in the Salalah area, but also in northern Oman. Also cultivated in private gardens and date orchards, rarely found as an escape.

### Casuarinaceae

#### *Casuarina equisetifolia* L.

Monoecious tree up to 30 m with whorls of pale green scale-leaves; male flowers in spikes; female flowers in ovoid heads. Bracteoles perianth and woody in fruit, forming a small cone-like structure 2–2.5 cm long. Cultivated in Oman as a wind-break and as a landscape tree in parks and public gardens. *Flowering and fruiting:* April, May.

### Juglandaceae

#### *Juglans regia* L.

*Vernacular names:* naksh.

Monoecious tree, up to 25 m with pinnate leaves, up to 40 cm long. Fruit (walnut) c. 5 cm long and wide. Cultivated (not on a commercial scale) at higher altitudes in the Jebel Akhdhar range, in the Saiy Plateau at Wadi Ham Habib and in a few villages in Wadi Mistal. The edible nut is valued for its taste and the leaves are used in traditional medicine to treat eczema. *Flowering and fruiting:* June to September.

### Muntingiaceae

#### *Muntingia calabura* L.

*Vernacular names:* Indian cherry tree.

Tree or shrub, up to 5 m. Leaves elliptic with serrate margins, very oblique at the base, stipules linear. Flowers yellow, solitary or in fascicles of 2–3; sepals and petals 5; stamens many. Fruit a globose berry, red when ripe.

Cultivated in northern Oman as a landscape tree, rarely found as an escape. Only a single record is known out of cultivation in northern Oman, which is from the Al Ansab sewage lagoons at Al Khuwair near Muscat.





# Distribution Maps

## Volume 1

Piperaceae - Primulaceae









Fig. 1. *Peperomia pellucida*.



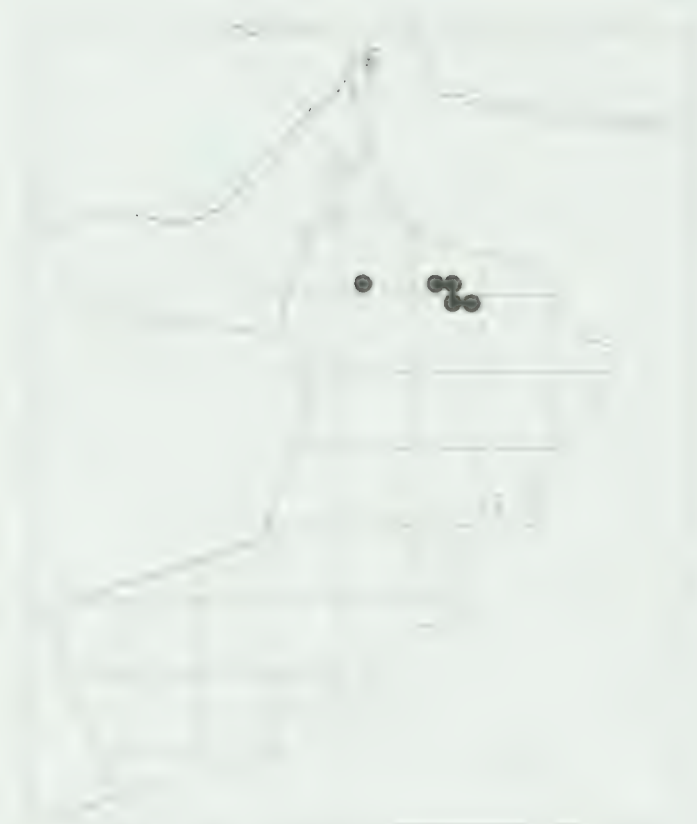
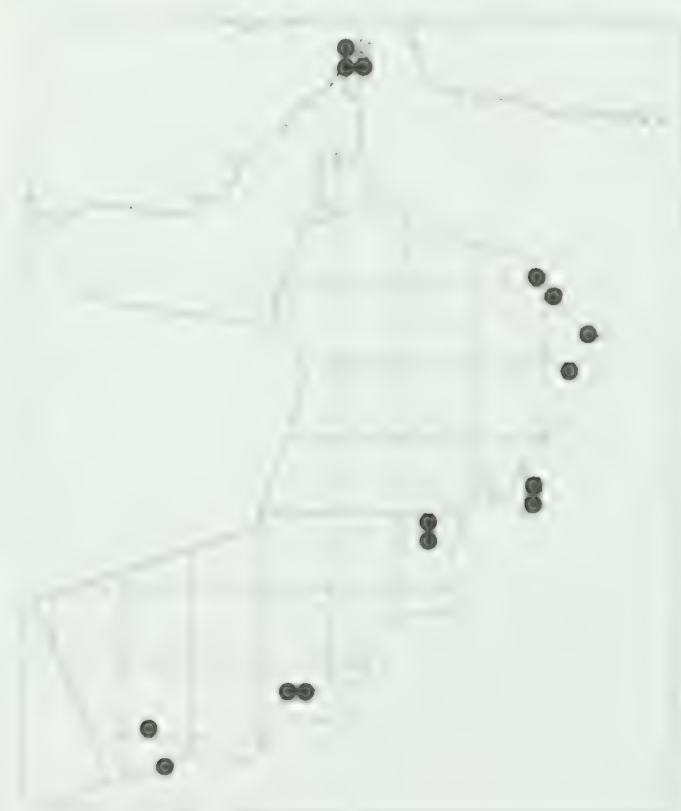
Fig. 2. *Aristolochia bracteolata*.



Fig. 3. *Ceratophyllum demersum*.



Fig. 4. *Clematis orientalis*.

Fig. 5. *Ranunculus muricatus*.Fig. 6. *Berxipia bialbistrigata*.Fig. 7. *Cocculus pendulus*.Fig. 8. *Cocculus balfourii*.



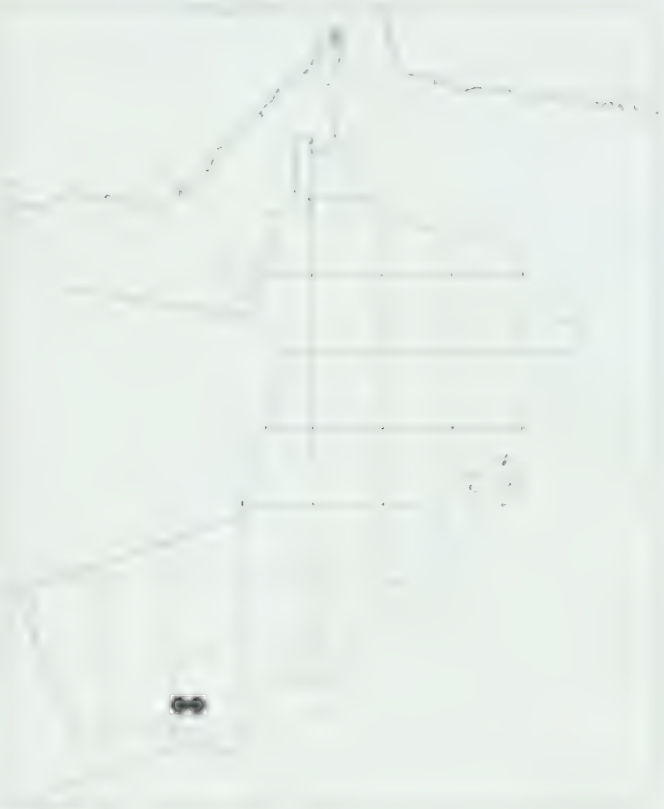


Fig. 9. *Argemone mexicana*.



Fig. 10. *Papaver decaisnei* ●.  
*P. dubium* subsp. *laevigatum* ■.



Fig. 11. *Humana abyssinica*.

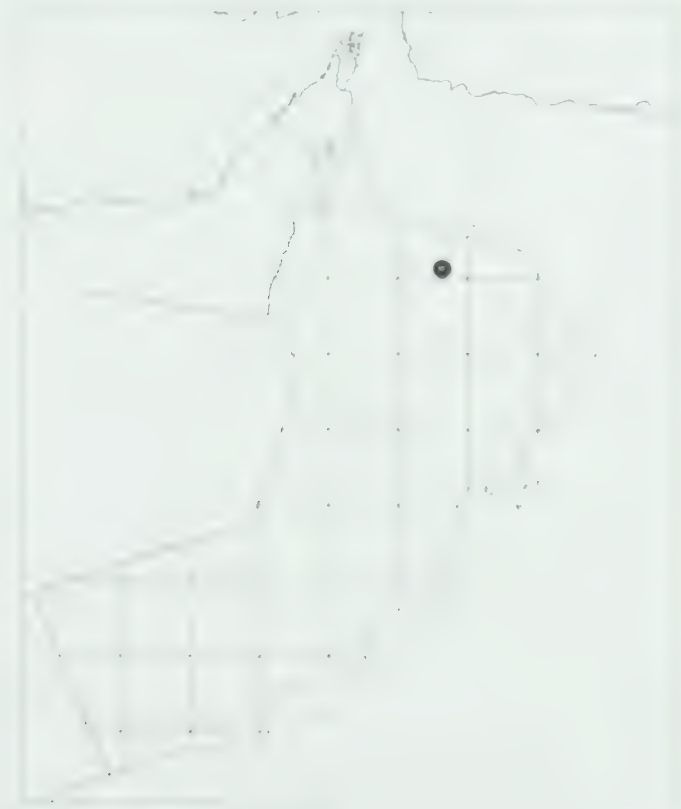


Fig. 12. *Trema orientalis*.

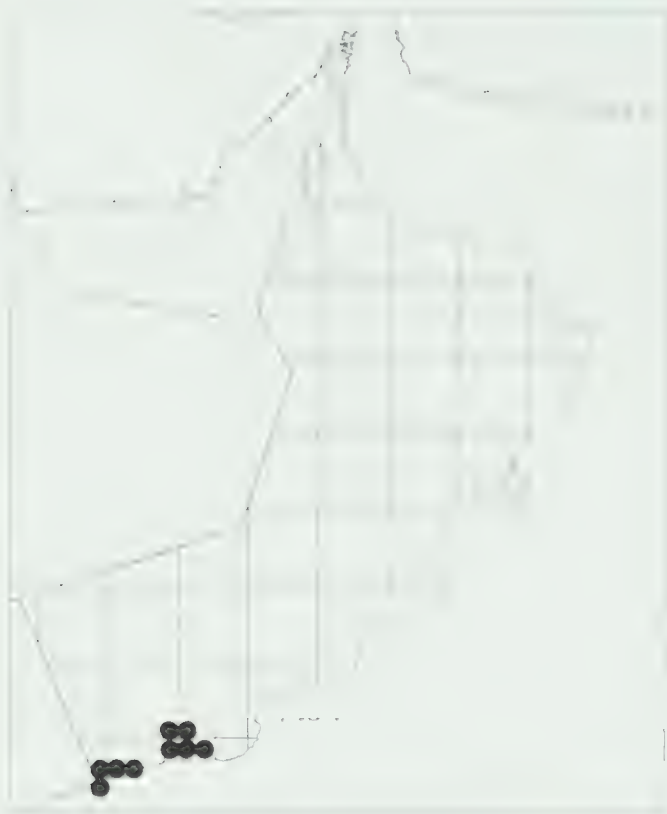


Fig. 13. *Dorstenia foetida* var. *foetida*.



Fig. 14. *Ficus carica*.



Fig. 15. *Ficus palmata* subsp. *palmata*.



Fig. 16. *Ficus johannis*.





Fig. 17. *Ficus viciifolia*.



Fig. 18. *Ficus cordata* subsp. *salicifolia*.



Fig. 19. *Ficus viciifolia*.



Fig. 20. *Ficus viciifolia*.

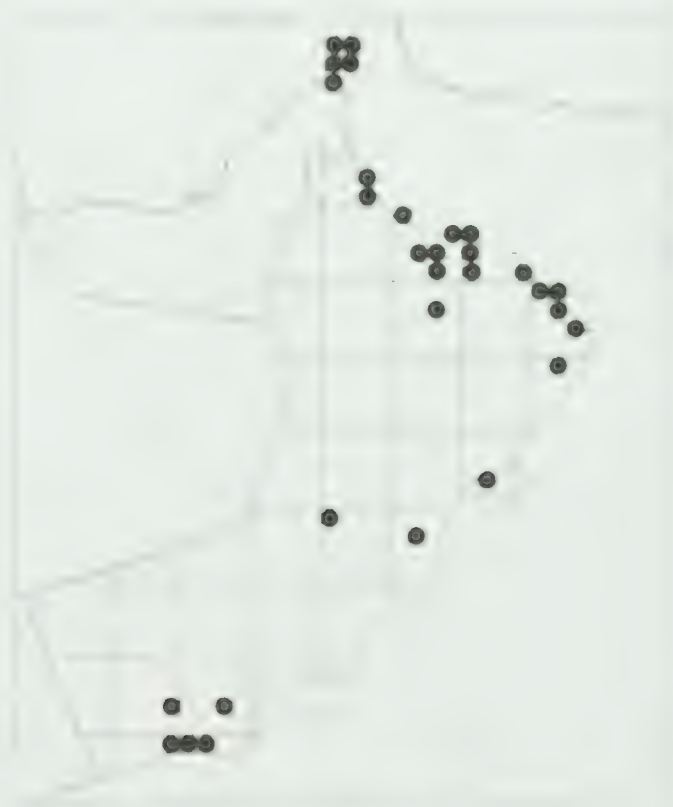
Fig. 21. *Pilea tetraphylla*.Fig. 22. *Laportea interrupta*.Fig. 23. *Parietaria alsinifolia*.Fig. 24. *Forsskaolea tenacissima*.





Fig. 25. *Forsskaolea viridis*.

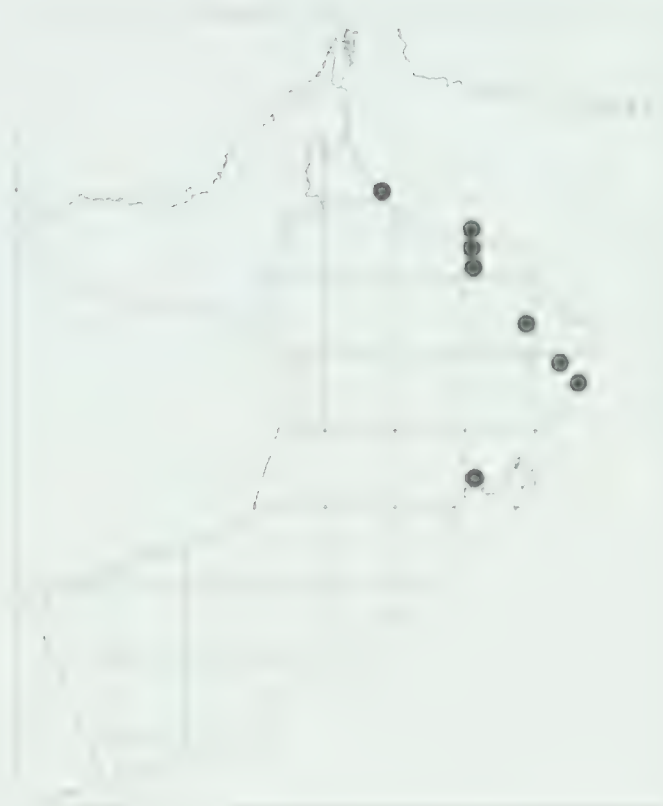


Fig. 26. *Gisekia pharnaceoides*.

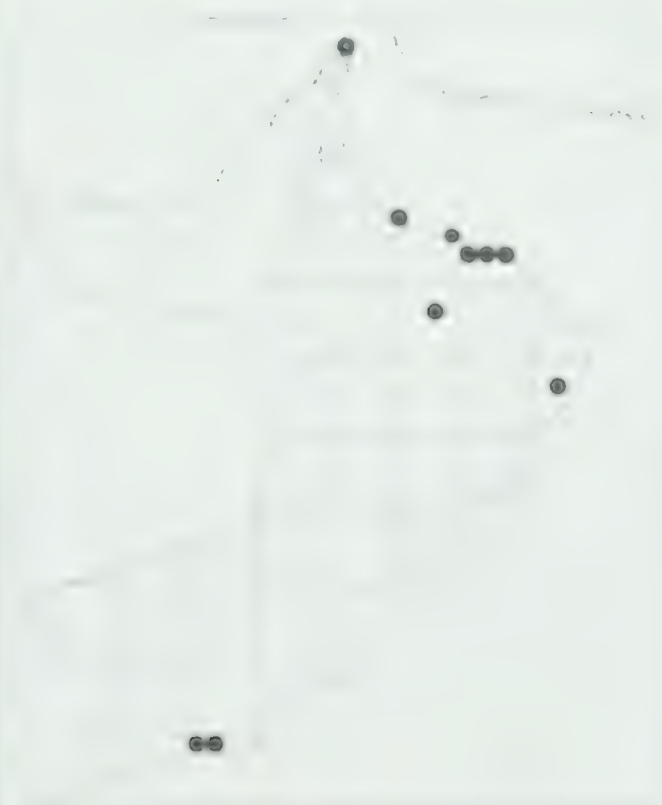


Fig. 27. *Boerhavia diffusa*.

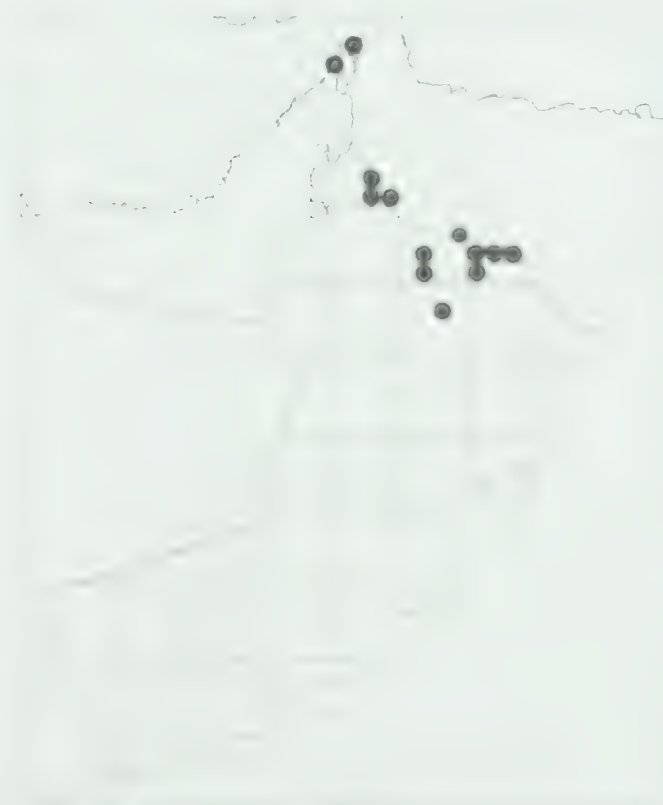


Fig. 28. *Boerhavia elegans*.

Fig. 29. *Commicarpus stenocarpus*.Fig. 30. *Commicarpus boissieri*.Fig. 31. *Commicarpus helenae*.Fig. 32. *Commicarpus mistus*.



Fig. 33. *Corbichonia decumbens*.



Fig. 34. *Trianthema portulacastrum*.



Fig. 35. *Trianthema triquetra*.

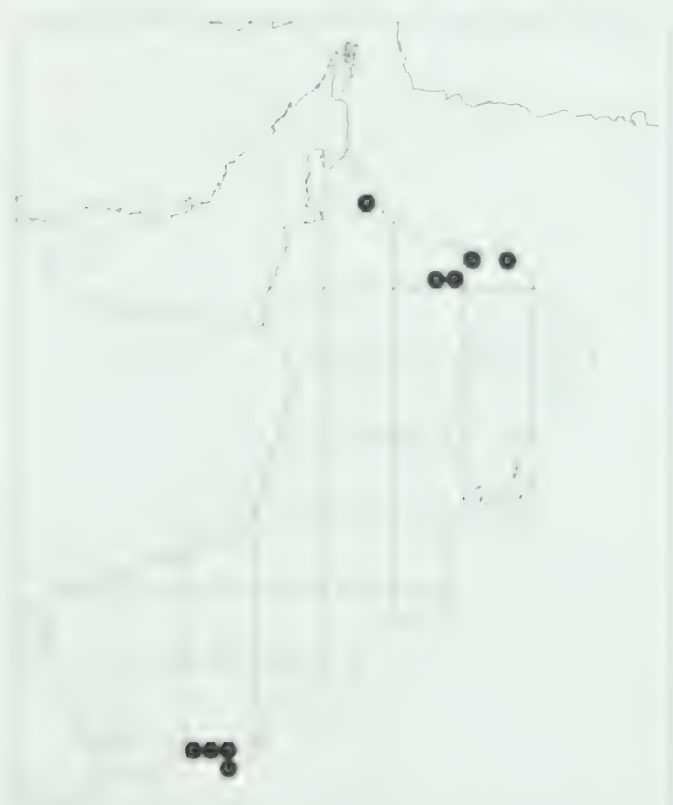


Fig. 36. *Zaleya pentandra*.



Fig. 37. *Aizoon canariensis*.Fig. 38. *Aizoon hispanicum*.Fig. 39. *Mesembryanthemum nodiflorum*.Fig. 40. *Chenopodium album*.



Fig. 41. *Chenopodium murale*.



Fig. 42. *Chenopodium vulvaria*.



Fig. 43. *Beta vulgaris* subsp. *maritima*.



Fig. 44. *Atriplex farinosa*.



Fig. 45. *Atriplex stocksii*.



Fig. 46. *Atriplex leucoclada* subsp. *inamoena*.



Fig. 47. *Agriophyllum minus*.



Fig. 48. *Bassia muricata*.





Fig. 49. *Haloprepis perfoliata*



Fig. 50. *Halocnemum strobilaceum*



Fig. 51. *Arthrocnemum subterminale*



Fig. 52. *Scirpus maritima*

Fig. 53. *Suaeda monoica*.Fig. 54. *Suaeda vermiculata*.Fig. 55. *Suaeda moschata*.Fig. 56. *Cornulaca aucheri*.



Fig. 57. *Chrysomelidae pyramidalis*.



Fig. 58. *Halogeton salicornicum*.



Fig. 59. *Halosiphia dracunculalis*.



Fig. 60. *Salicornia coronatilis*.



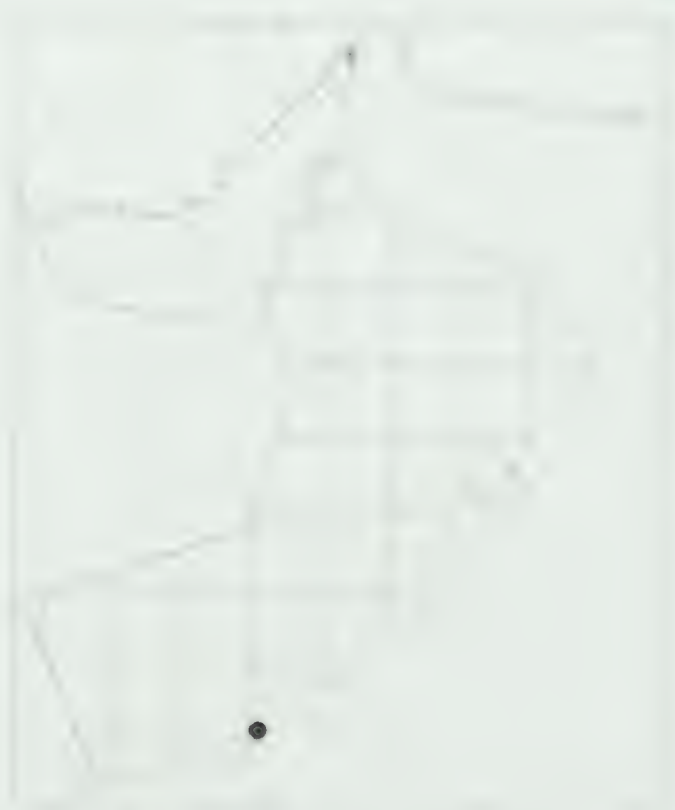
Fig. 61. *Salsola rubescens*.Fig. 62. *Salsola omanensis*.Fig. 63. *Salsola cyclophylla*.Fig. 64. *Salsola spinescens*.



Fig. 65. *Salsola imbricata*.



Fig. 66. *Halothamnus bortae*.



Fig. 67. *Sevada schumperi*.

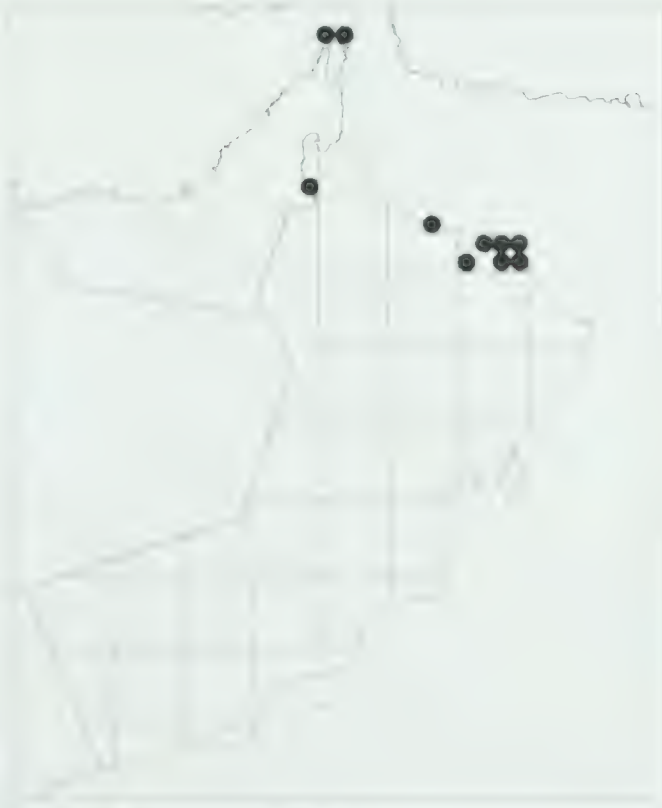


Fig. 68. *Anabasis setifera*.

Fig. 69. *Celosia trigyna*.Fig. 70. *Celosia argentea*.Fig. 71. *Amaranthus hybridus*.Fig. 72. *Amaranthus dubius*.





Fig. 73. *Amaranthus granatensis*.



Fig. 74. *Amaranthus sparganocephalus*.



Fig. 75. *Amaranthus spinosus*.



Fig. 76. *Discaria ovata*.

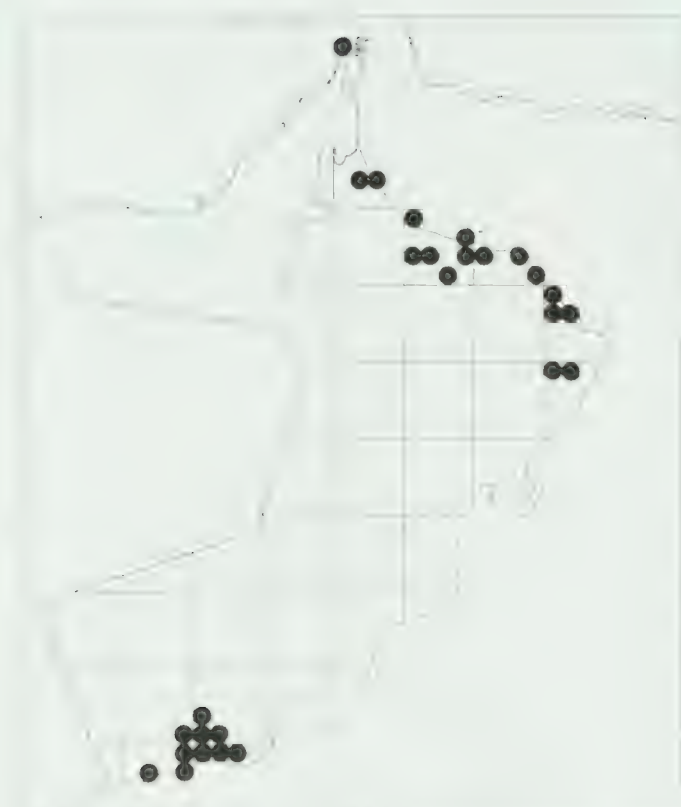
Fig. 77. *Pupalia lappacea* var. *velutina*.Fig. 78. *Aerva liliifolia*.Fig. 79. *Aerva artemisioides* subsp. *batharitica*.Fig. 80. *Ptilimnium* sp.



Fig. 81. *Adiantum* sp.



Fig. 82. *Alismanthus pungens*



Fig. 83. *Goniopsis pectinoides*



Fig. 84. *Thymus albus*



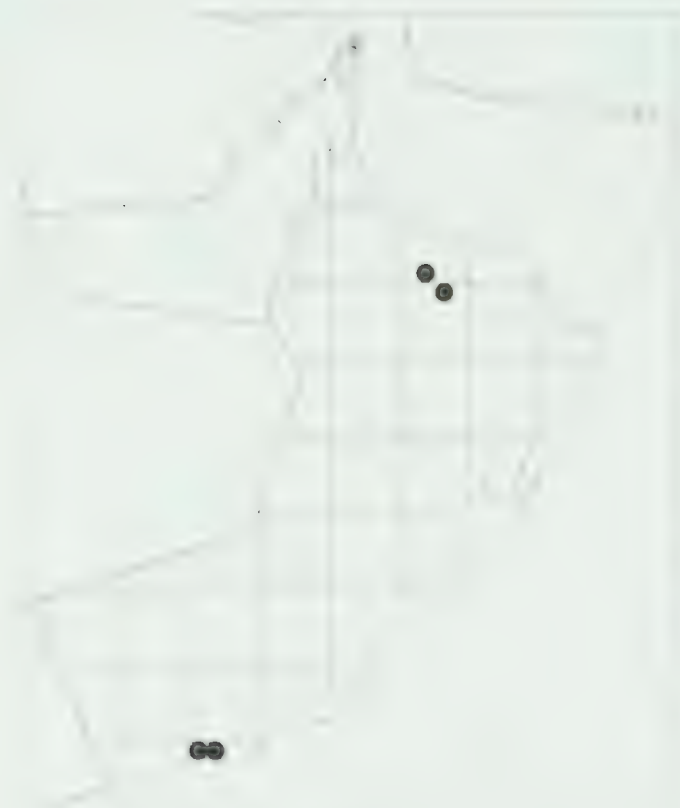
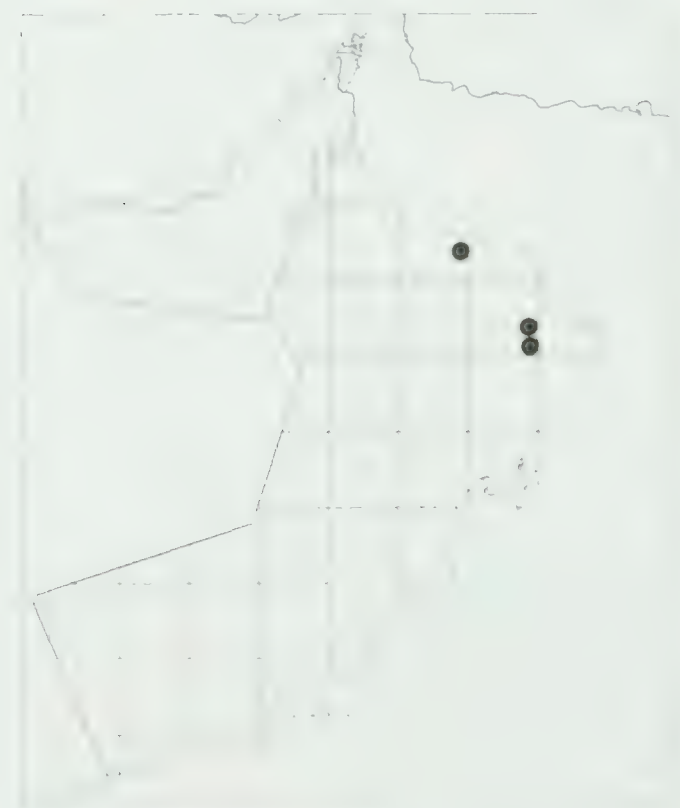
Fig. 85. *Portulaca quadrifida*.Fig. 86. *Portulaca dhofarica*.Fig. 87. *Limeum arabicum*.Fig. 88. *Limeum obovatum*.



Fig. 88. *Clitellina tridens*.



Fig. 90. *Molliga leonensis*.



Fig. 91. *Lomocera nautica*.



Fig. 92. *Lomocera nautica*.



Fig. 93. *Gymnocarpus decandrus*.



Fig. 94. *Gymnocarpus rotundifolius*.



Fig. 95. *Gymnocarpus dhofarensis*.



Fig. 96. *Sphaerocoma aucheri*.





Fig. 97 *Pannychis arbutus*



Fig. 98 *Selencephalus arbutus*



Fig. 99 *Eremophila arbutus*



Fig. 100 *Hyemidius arbutus*

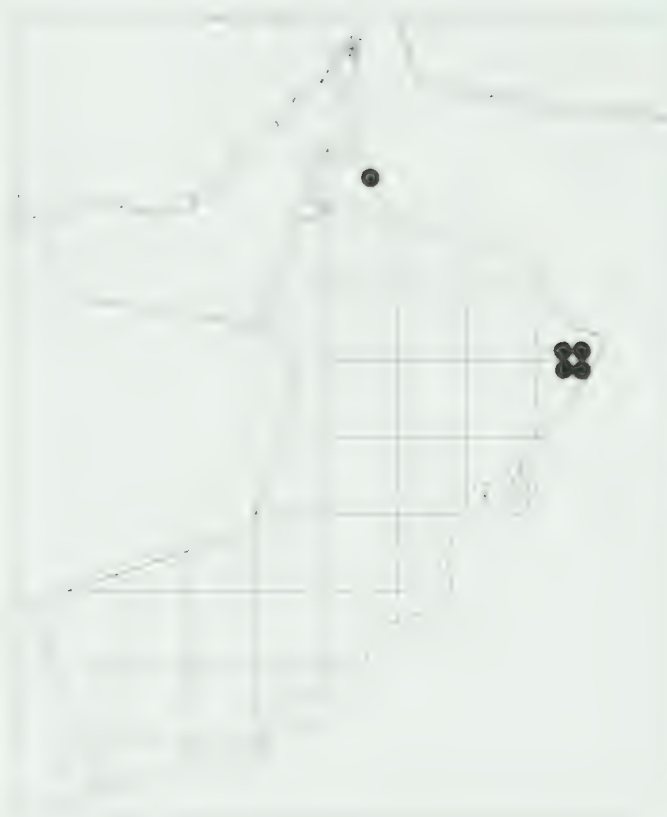
Fig. 101. *Polycarpaea repens*.Fig. 102. *Polycarpaea spicata*Fig. 103. *Polycarpaea jazirensis*Fig. 104. *Polycarpaea robbairea*



Fig. 105. *Xanthoxylum arabicum*



Fig. 106. *Polycarpon tetraphyllum*



Fig. 107. *Polycarpon monanthum*



Fig. 108. *Sparganium angustifolium*





Fig. 109. *Spergularia bocconi*.

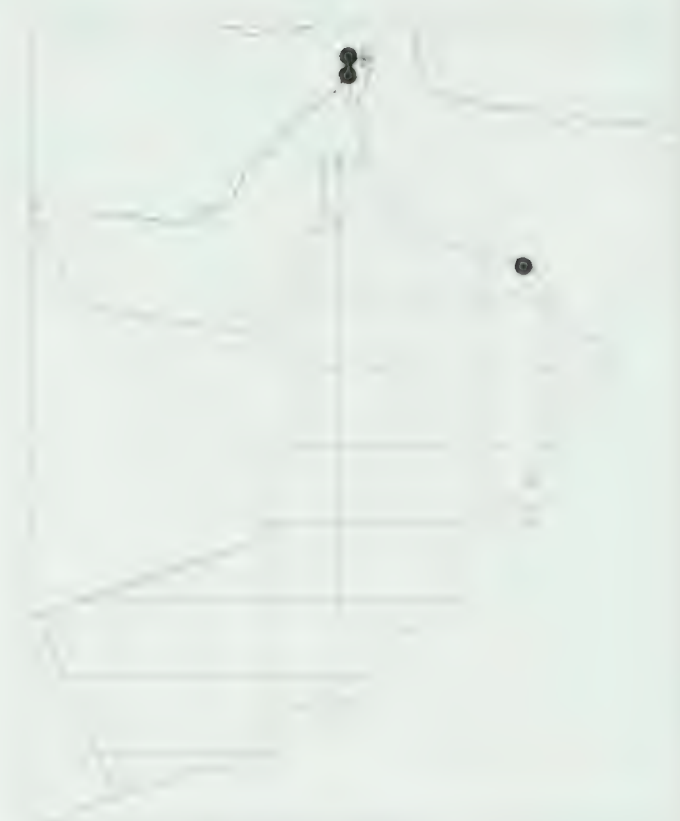


Fig. 110. *Spergularia diandra*.



Fig. 111. *Spergularia marina*.

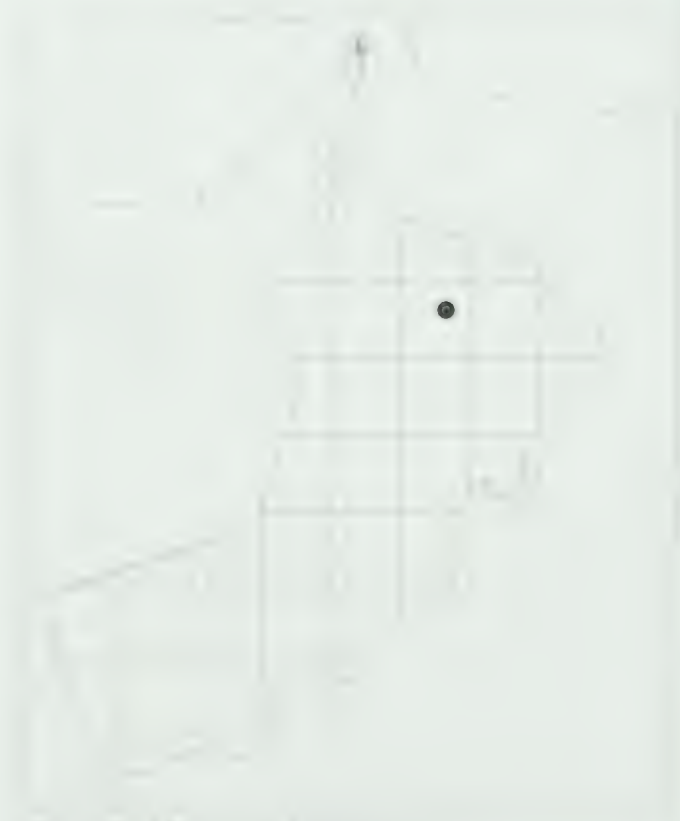


Fig. 112. *Minuartia hybrida*.



Fig. 113. *Minuartia meyeri*.



Fig. 114. *Holosteum platyneuron*.



Fig. 115. *Arenaria leptocladius*.



Fig. 116. *Stellaria media*.

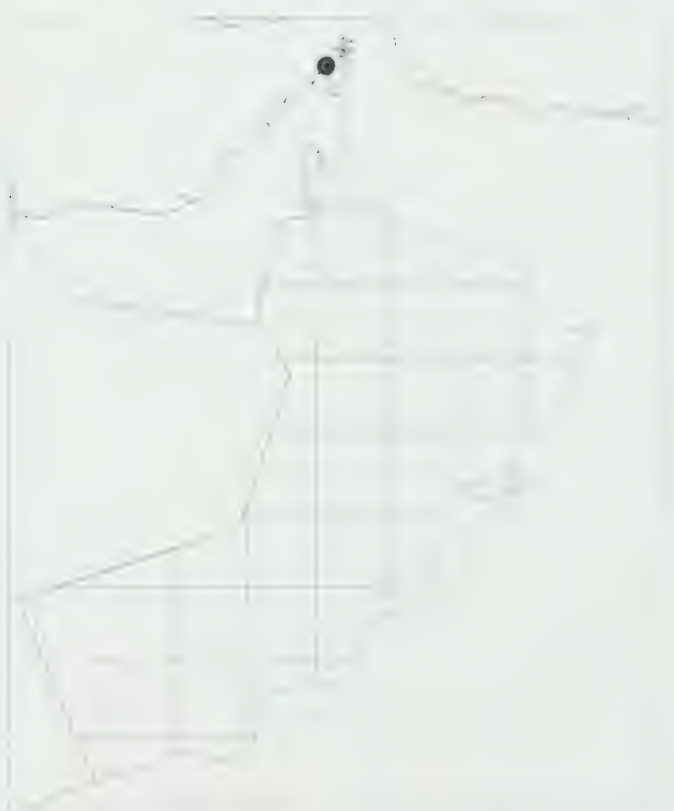
Fig. 117. *Silene conoidea*.Fig. 118. *Silene apertum*.Fig. 119. *Silene villosa*.Fig. 120. *Silene austroiranica*.





Fig. 121. *Silene schweinfurthii*.



Fig. 122. *Gypsophila bellantolia*.



Fig. 123. *Gypsophila montana*.



Fig. 124. *Dianthus cyri*.



Fig. 125. *Dianthus crinitus*.



Fig. 126. *Polygonum glabrum*.



Fig. 127. *Rumex vesicarius*.

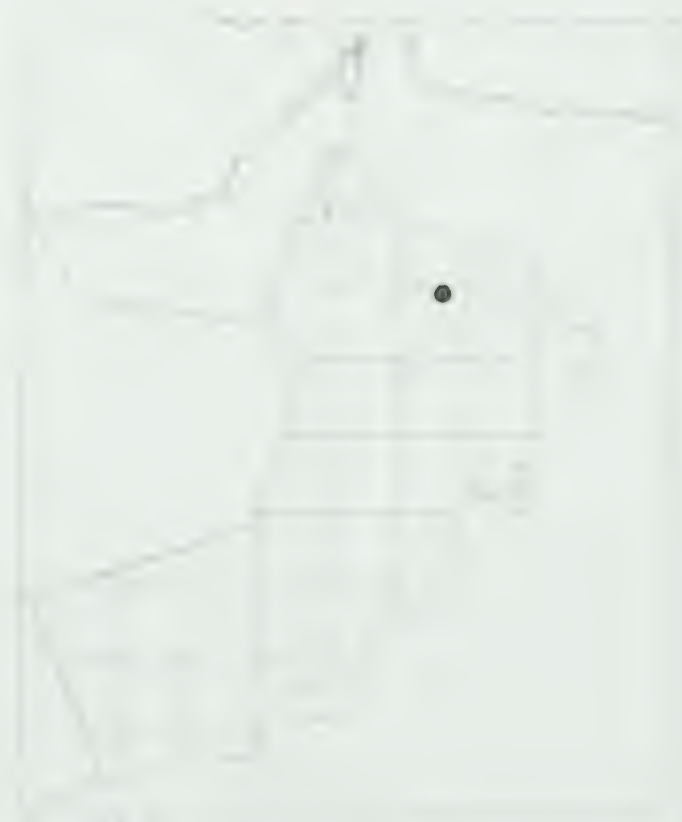


Fig. 128. *Rumex limoniastrum*.



Fig. 129. *Rumex conglomeratus*.

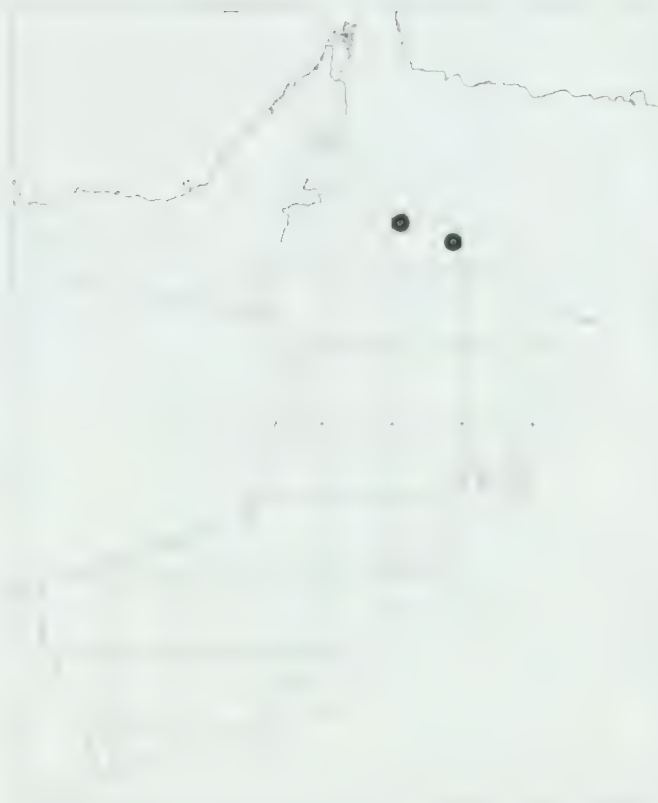


Fig. 130. *Rumex dentatus*.



Fig. 131. *Rumex spinosa*.



Fig. 132. *Calligonum comosum*.





Fig. 133. *Calligonum crinitum* subsp. *arabicum*.



Fig. 134. *Calligonum tetrapterum*.



Fig. 135. *Pteroporum scoparium*.



Fig. 136. *Plumbago zeylanica*.



Fig. 137 *Laminaria axillare*



Fig. 138 *Laminaria stocksii*



Fig. 139 *Laminaria, unguiculata*



Fig. 140 *Laminaria, unguiculata*

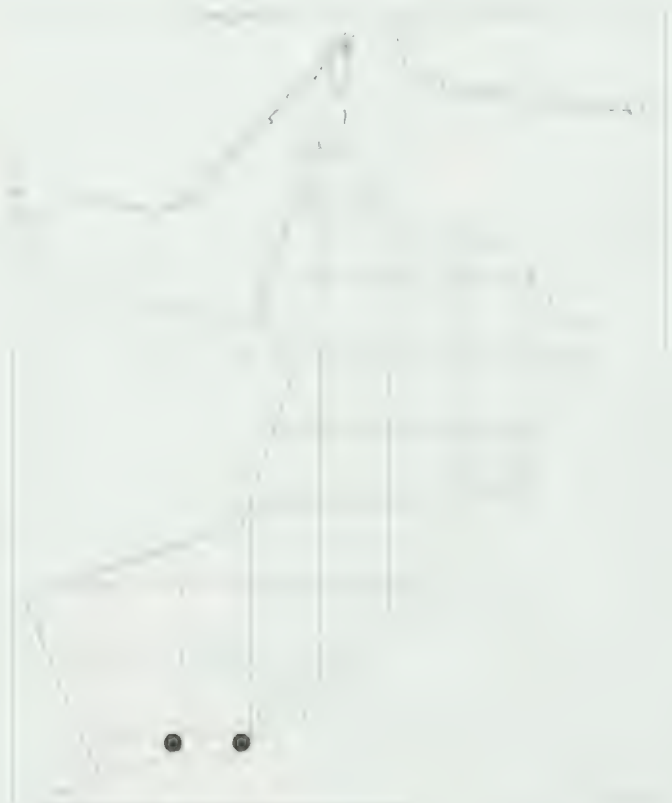
Fig. 141. *Limonium carnosum*.Fig. 142. *Dyerophytum indicum*Fig. 143. *Grewia damine*.Fig. 144. *Grewia erythraea*





Fig. 145. *Grewia tenax*.



Fig. 146. *Grewia villosa*.



Fig. 147. *Corchorus depressus*.



Fig. 148. *Corchorus olitorius*.

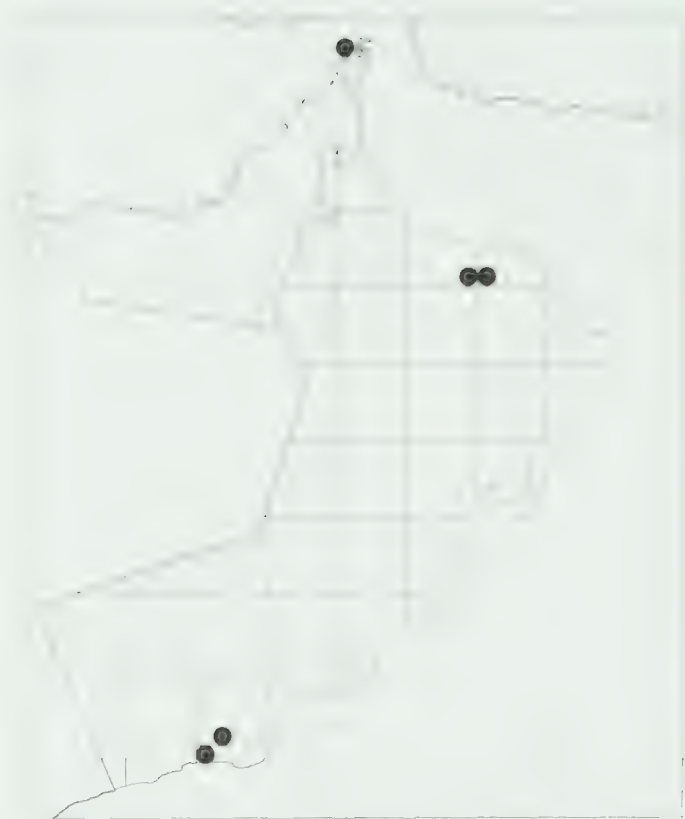
Fig. 149. *Corchorus trilocularis*.Fig. 150. *Corchorus aestuans*.Fig. 151. *Triumfetta pentandra* ●;  
*Triumfetta* sp. A ■.Fig. 152. *Melhania ovata* var. *abyssinica*.



Fig. 153. *Meloborisopirana*.



Fig. 154. *Meloborisopirana*.



Fig. 155. *Hermannia paniculata*.



Fig. 156. *Hermannia testacea*.





Fig. 157. *Glossostemon bruguieri*.



Fig. 158. *Sterculia atricoma*.



Fig. 159. *Adansonia digitata*.



Fig. 160. *Hibiscus trionum*.



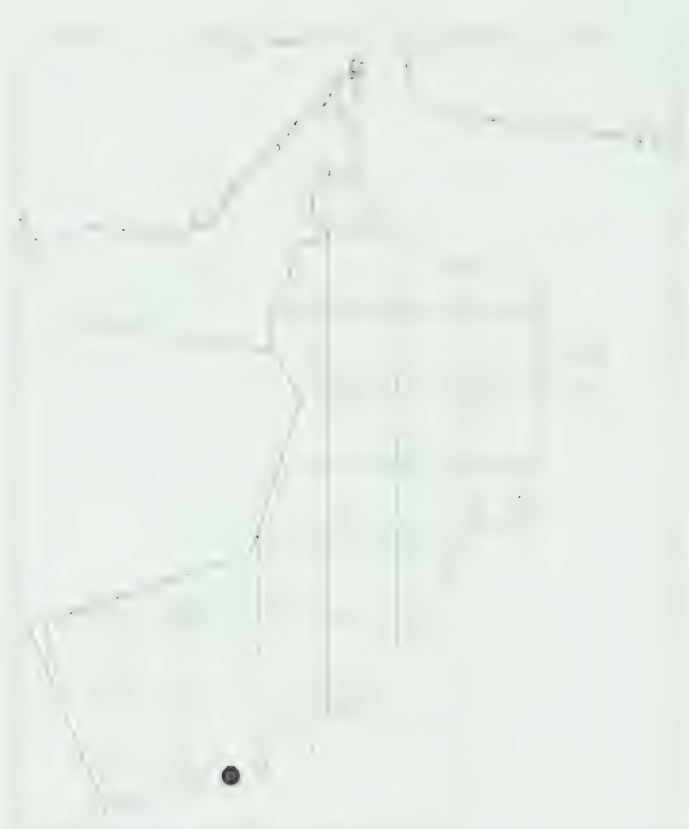


Fig. 165. *Hibiscus deflersii*.



Fig. 166. *Hibiscus micranthus*.

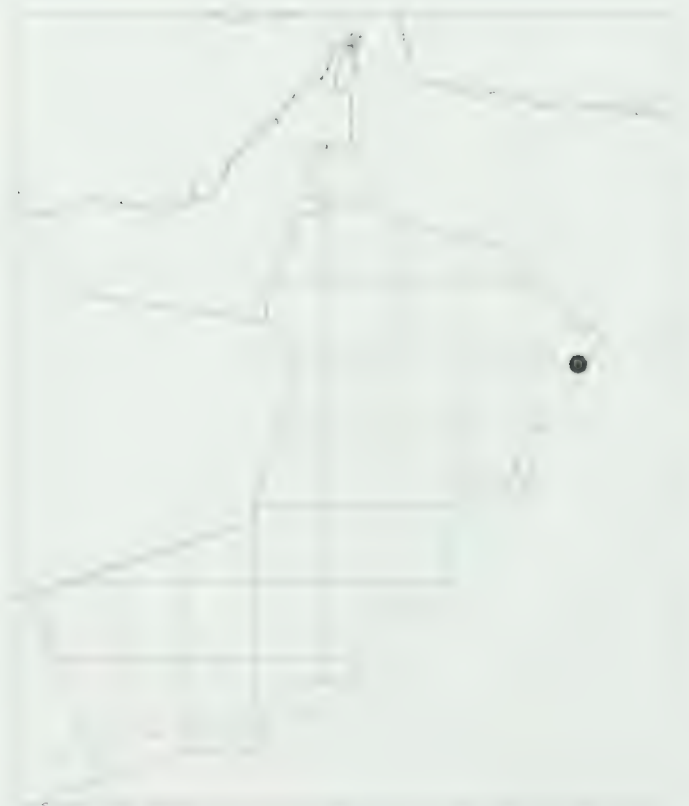


Fig. 167. *Hibiscus scindicus*.



Fig. 168. *Hibiscus* spp. A and B.





Fig. 169. *Abelmoschus esculentus*.



Fig. 170. *Abelmoschus manihot*.



Fig. 171. *Senra incana*.



Fig. 172. *Cientuegosia welshii*.

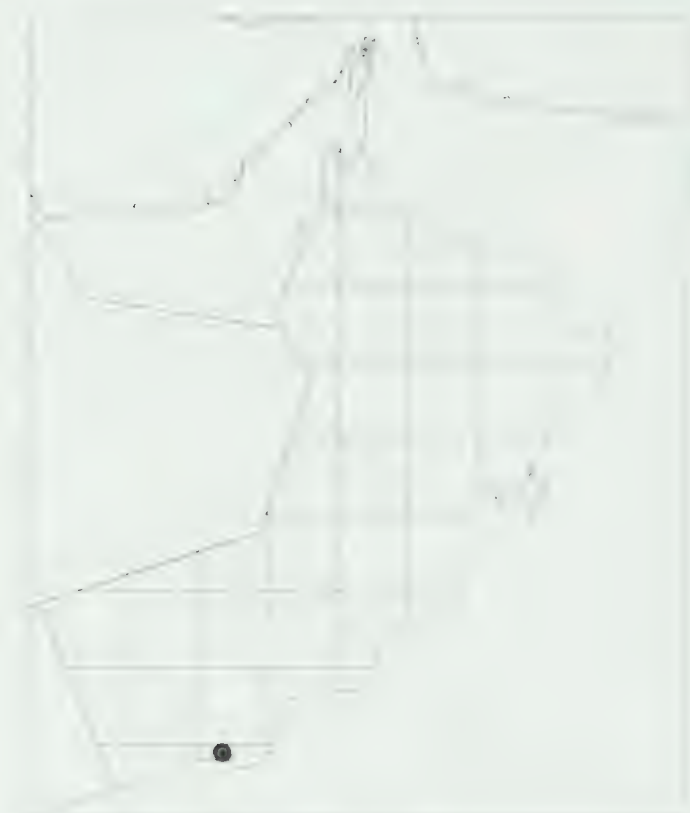
Fig. 173. *Gossypium stocksii*.Fig. 174. *Pavonia glechonifolia*.Fig. 175. *Pavonia arabica*.Fig. 176. *Pavonia pirottae*.



Fig. 177 *Pinguicula vulgaris*



Fig. 178 *Pinguicula lusitanica*



Fig. 179 *Malva pumila*

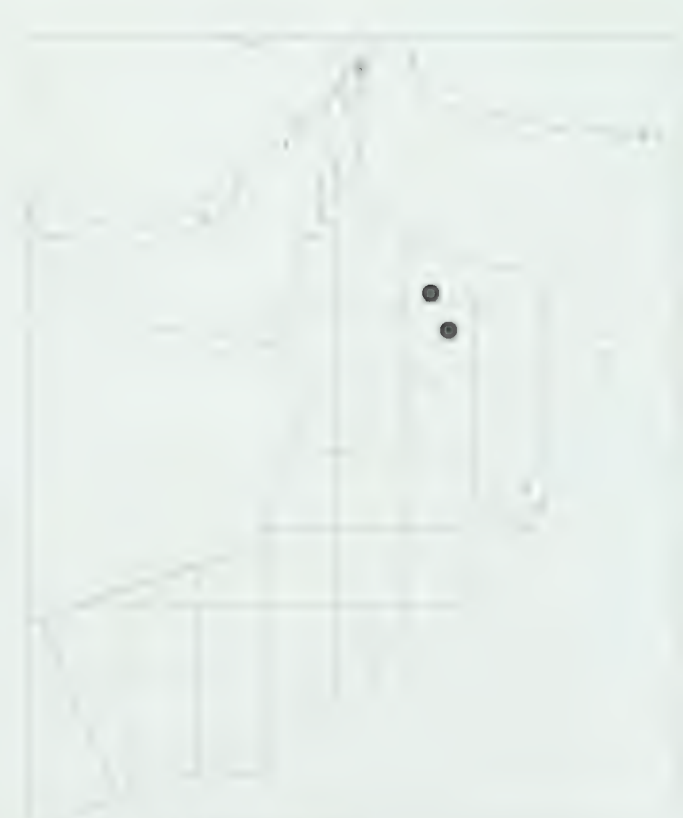


Fig. 180 *Malva neglecta*



Fig. 181. *Abutilon fruticosum*.Fig. 182. *Abutilon mauritianum*.Fig. 183. *Abutilon bidentatum*.Fig. 184. *Abutilon pannosum*.



Fig. 184. *Alouatta palliata*.



Fig. 185. *Aotus melanotus*.



Fig. 187. *Alouatta palliata*.



Fig. 188. *Malvastrum coromandelianum*.

Fig. 189. *Sida cordata*.Fig. 190. *Sida spinosa*.Fig. 191. *Sida ovata*.Fig. 192. *Sida urens*.





Fig. 193. *Helianthemum salicifolium*.

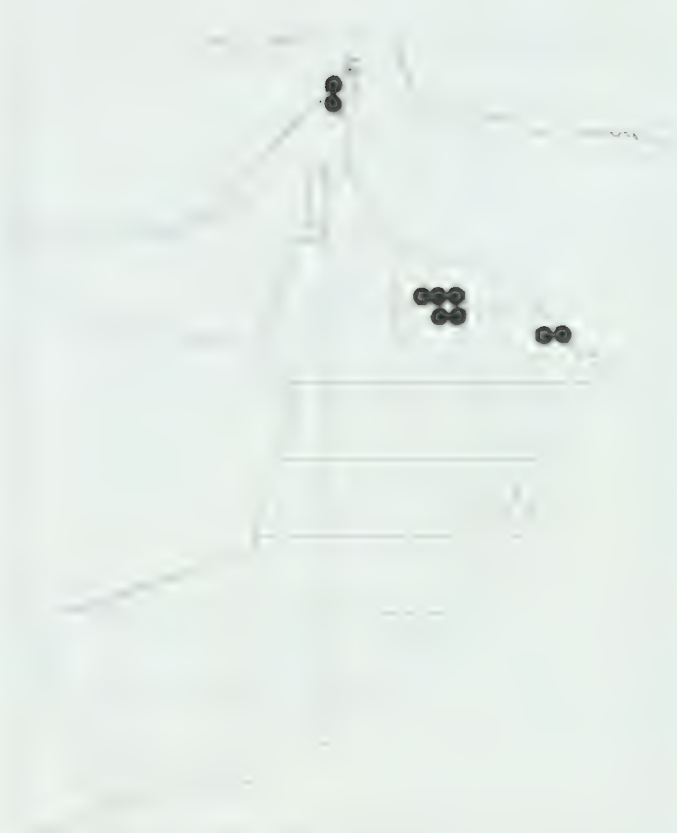


Fig. 194. *Helianthemum lippii*.



Fig. 195. *Helianthemum kalericum*.



Fig. 196. *Helianthemum citrinum*.



Fig. 197. *Viola cinerea* var. *cinerea*;  
*V. cinerea* var. *stocksii*.



Fig. 198. *Hybanthus durus*.

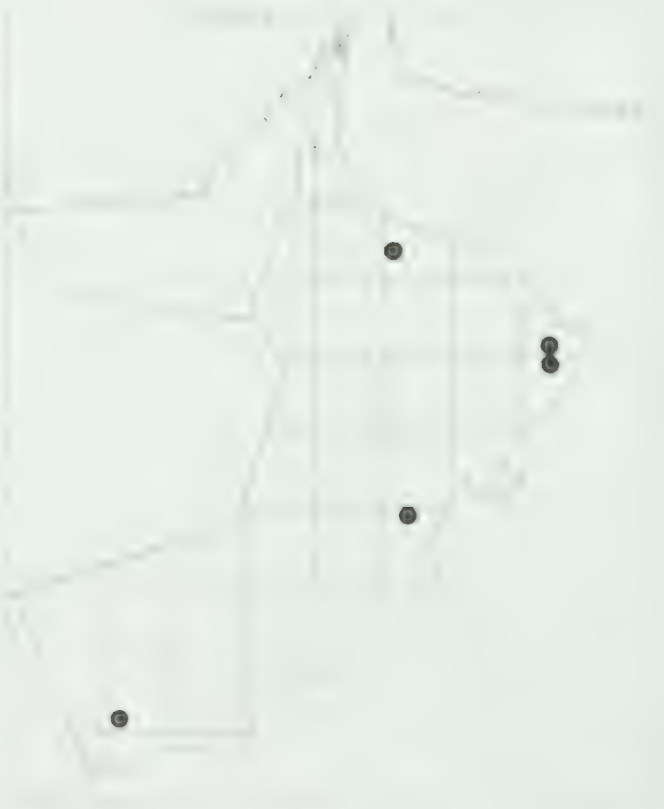


Fig. 199. *Tamarix arabica*



Fig. 200. *Tamarix mascatensis*



Fig. 201. *Tamarix aphylla*.



Fig. 202. *Tamarix stricta*.



Fig. 203. *Tamarix aucheriana*.



Fig. 204. *Frankenia pulverulenta*.





Fig. 205. *Corallocarpus epigaeus*.



Fig. 206. *Corallocarpus glomeruliformis*.



Fig. 207. *Zehneria anomala*.



Fig. 208. *Cucumis melo* subsp. *agrestis*.



Fig. 209. *Cucumis sativus*.



Fig. 210. *Cucumis pustulatus*.



Fig. 211. *Cucumis prophetarum* subsp. *prophetarum*.



Fig. 212. *Cucumis canoxyi*.

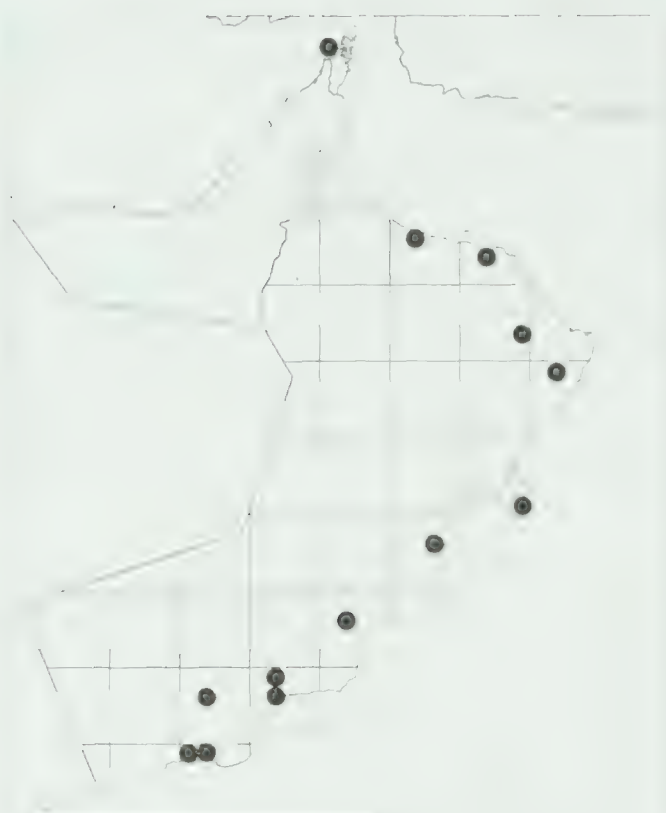
Fig. 213. *Citrullus colocynthis*.Fig. 214. *Diplocyclos palmatus*.Fig. 215. *Mukia maderaspatana*.Fig. 216. *Luffa acutangla*.



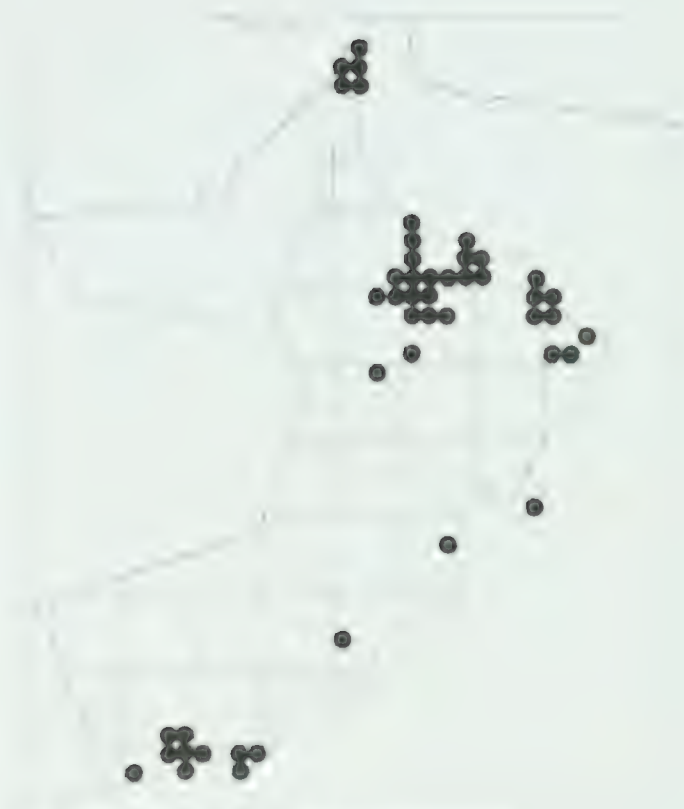
Fig. 217. *Quercus ensiphylla*.Fig. 218. *Quercus crassifolia*.Fig. 219. *Quercus colorata*.Fig. 220. *Quercus indurata*.

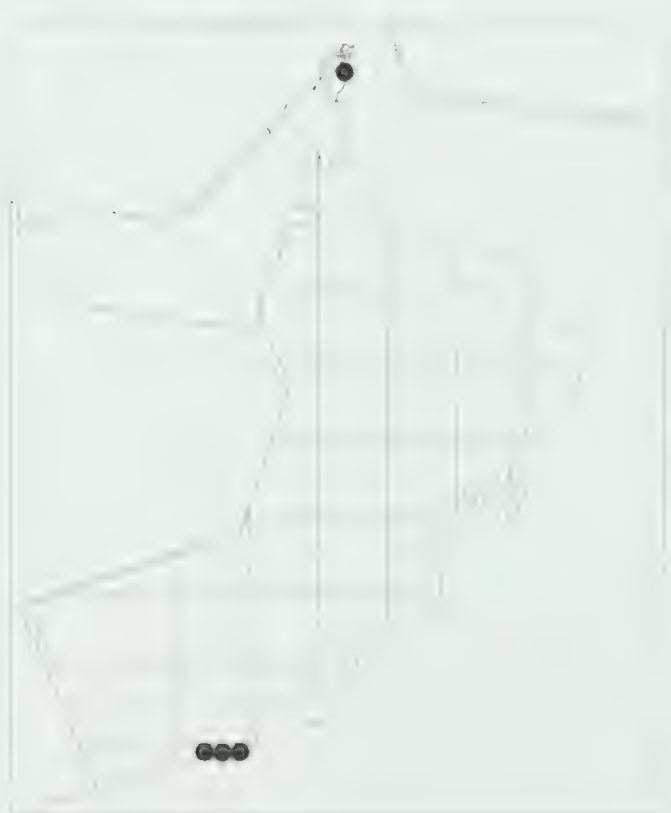
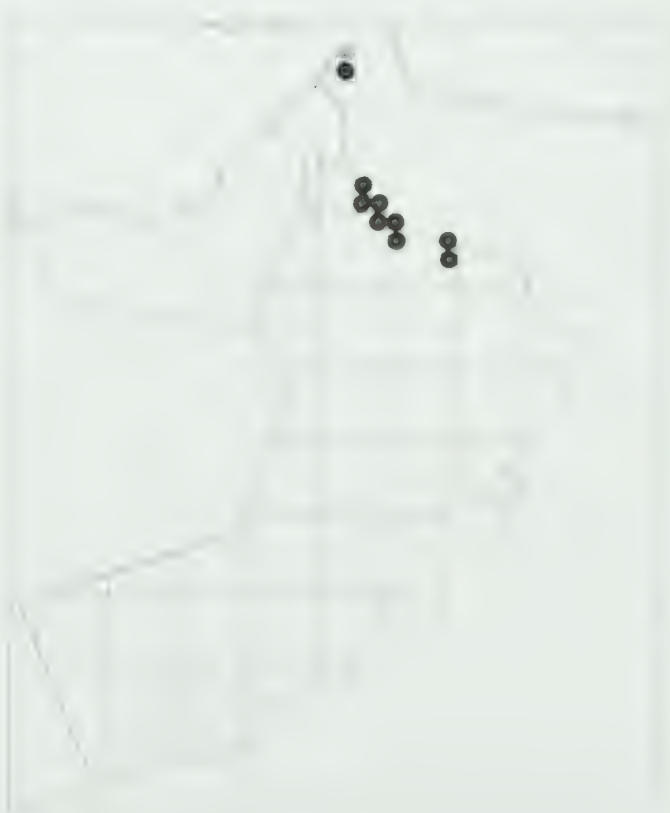
Fig. 221. *Cadaba heterotricha*.Fig. 222. *Cadaba farinosa*.Fig. 223. *Cadaba baccarinii*.Fig. 224. *Capparis decidua*.



Fig. 225. *Capparis spinosa*.



Fig. 226. *Capparis cartilaginea*.



Fig. 227. *Hibiscus grandifolius*.



Fig. 228. *Cleome scaposa*.



Fig. 229. *Cleome brachycarpa*.

Fig. 230. *Cleome amblyocarpa*.

Fig. 231. *Cleome brevipetiolata*.

Fig. 232. *Cleome austroarabica* subsp. *austroarabica* (●); subsp. *muscatensis* (■).



Fig. 233. *Cleome noeana*.



Fig. 234. *Cleome rupicola*.



Fig. 235. *Cleome albescens* subsp. *omanesis*.



Fig. 236. *Cleome gynandra*.

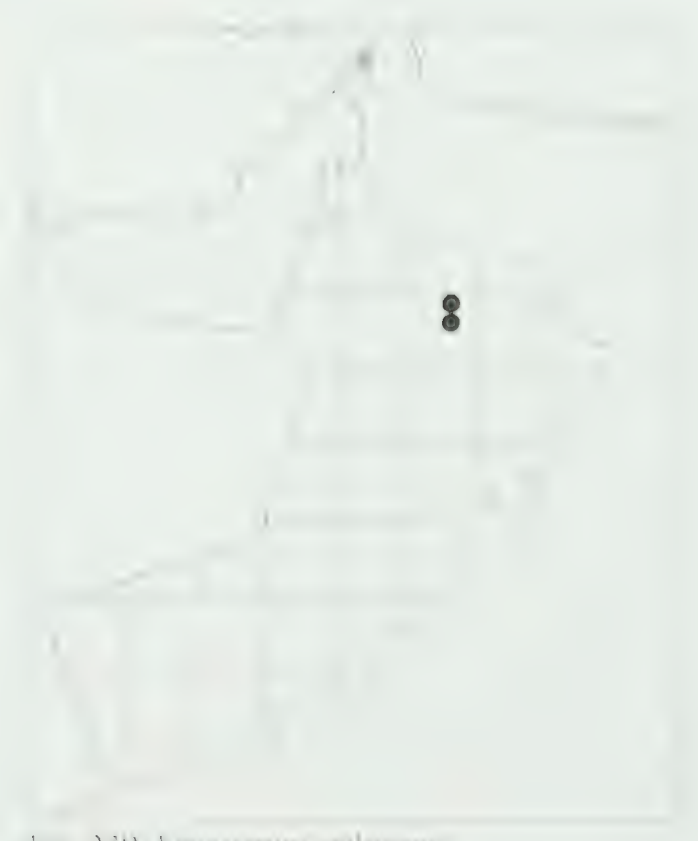
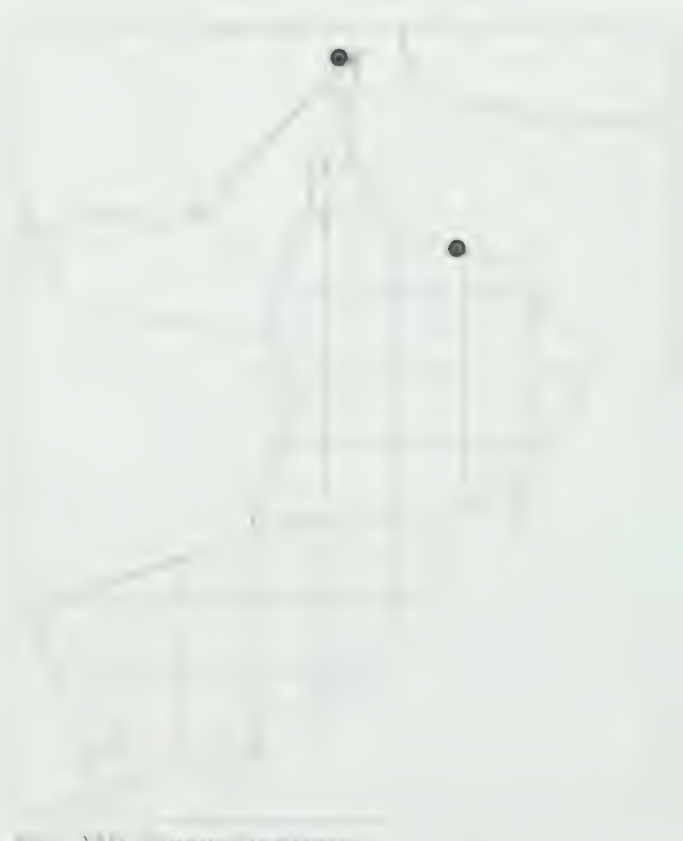
Fig. 237. *Dipterygium glaucum*Fig. 238. *Brassica juncea*Fig. 239. *Ficus religiosa*Fig. 240. *Sinapis crebra*





Fig. 241. *Diplazysia harra*.



Fig. 242. *Diplazysia acuta*.



Fig. 243. *Dicranotus*.



Fig. 244. *Raphanus raphanistrum*.



Fig. 245. *Frucaria hispanica*.



Fig. 246. *Frucaria* sp. A.



Fig. 247. *Zilla spinosa*.



Fig. 248. *Physorhynchus chamaerapistrum*.



Fig. 249. *Savignya parviflora*.



Fig. 250. *Monarda amurensis*.



Fig. 251. *Lepidium aucheri*.



Fig. 252. *Lepidium sativum*.



Fig. 253. *Coronopus didymus*.Fig. 254. *Cardamine draba*.Fig. 255. *Capsella bursa-pastoris*.Fig. 256. *Anastatica hieracuntica*.



Fig. 257. *Farsetia aegyptia*



Fig. 258. *Farsetia latifolia*.

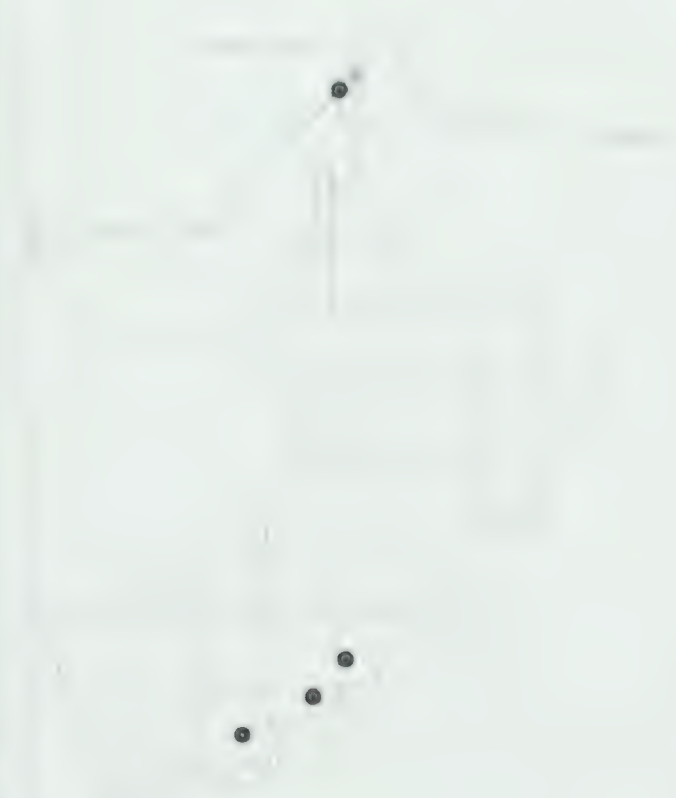


Fig. 259. *Farsetia stylosa*



Fig. 260. *Farsetia linearis*.

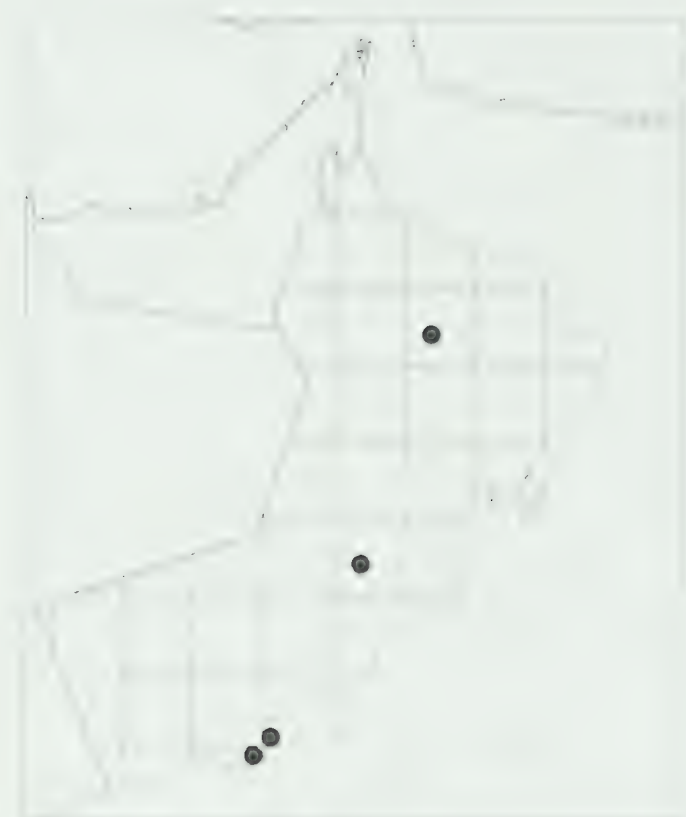
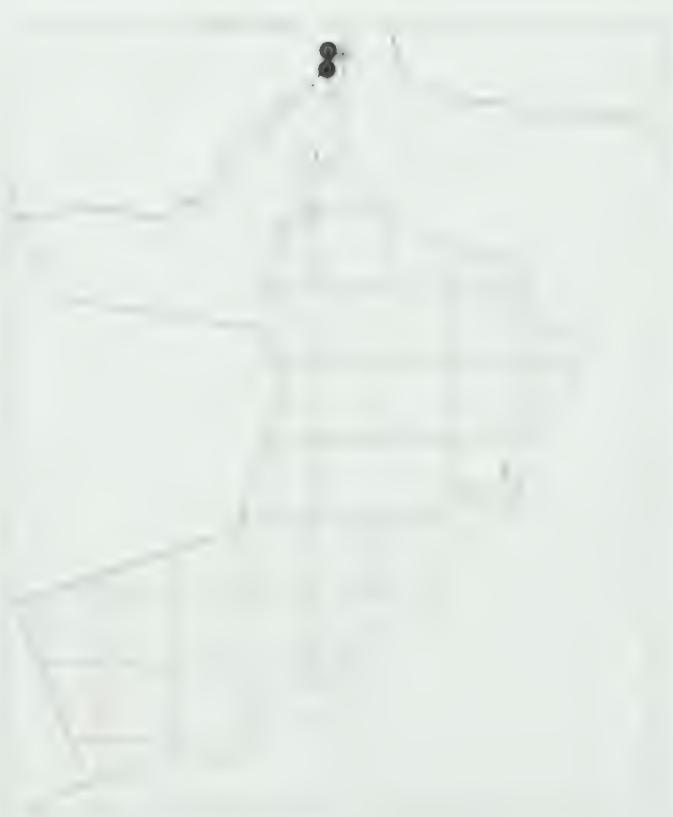
Fig. 261. *Farsetia longisiliqua*.Fig. 262. *Farsetia heliophila*.Fig. 263. *Farsetia dhofarica*.Fig. 264. *Erophila verna*.





Fig. 265. *E. typus ponticus*



Fig. 266. *Cypripedium asperum*



Fig. 267. *S. ...*



Fig. 268. *M. ...*



Fig. 269. *Morettia philacana*.



Fig. 270. *Malcolmia africana*.



Fig. 271. *Eremobium aegyptiacum*.



Fig. 272. *Sisymbrium irio*.



Fig. 273. *Sisymbrium crysimoides*.



Fig. 274. *Arabidopsis pumila*.



Fig. 275. *Moringa peregrina*.



Fig. 276. *Ochradenus baccatus*.





Fig. 277. *Ochradenus arabicus*.



Fig. 278. *Ochradenus harsusiticus*.



Fig. 279. *Ochradenus gifrii*.



Fig. 280. *Ochradenus aucheri*.



Fig. 281. *Oligimerus linifolia*.



Fig. 282. *Reseda aucheri* var. *bracteata*.



Fig. 283. *Reseda muricata*.



Fig. 284. *Reseda sphenocleoides*.

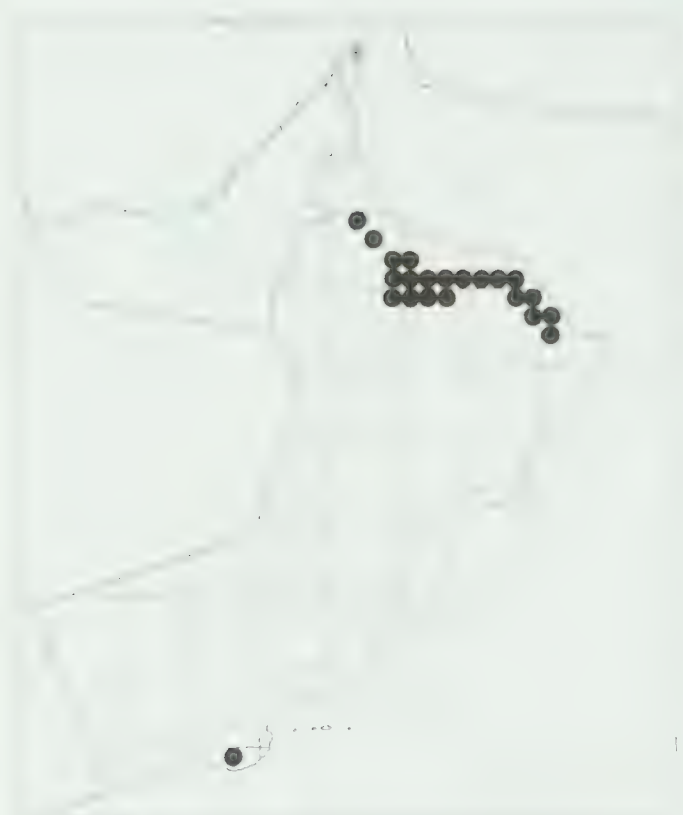


Fig. 285. *Sideroxylon mascatensis*.



Fig. 286. *Euclea racemosa* subsp. *schimperi*



Fig. 287. *Anagallis arvensis*.



Fig. 288. *Anagallis pumila*.





Fig. 289. *Samolus valerandi*.



Fig. 290. *Dionysia mira*.



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## Index of species and vernacular names

### A

- abal, 84-85  
 Abelmoschus, 105  
   esculentus, 105  
   manihot, 106  
 Abutilon, 111  
   bidentatum, 112  
   fruticosum, 111  
   glaucum, 112  
   hirtum, 112  
   indicum, 113  
   mauritianum, 111  
   muticum, 112  
   pannosum, 112  
 Achyranthes, 55, 57  
   aspera, 57  
     var. *indica*, 57  
     var. *pubescens*, 58  
     var. *siemli*, 58  
   *indica*, 57  
   *javanica*, 56  
   *lappacea*, 55  
   *muricata*, 55  
 Adansonia, 99  
   digitata, 99  
 Aerva, 56  
   artemisioides, 56  
     subsp. *batharitica*, 56  
   *javanica*, 56  
   *tomentosa*, 56  
 atar, 39, 40  
 atkar, 43  
 Agriophyllum, 41  
   minus, 41  
   *montastru*, 41  
 agul, 133  
 alisebe elhuti, 125  
 Arzoaceae, 32  
 Arzoon, 34  
   canariensis, 35  
   hispanicum, 35  
 akimbor, 91  
 al belib, 134  
 Alcea rosea, 115  
 Alsine  
   *bocconii*, 72  
   *media*, 75  
   *meyeri*, 74  
 Alternanthera, 58  
   pungens, 58  
 Althaea, 113  
   ludwigii, 113  
   *rosea*, 115  
 Amaranthaceae, 51  
 Amaranthus, 52  
   dubius, 53  
   gracilis, 54  
   gracizans, 53  
     subsp. *thellungianus*, 54  
     subsp. *silvestris*, 54  
   hybridus, 53  
     subsp. *cruentus*, 53  
   sparganiocephalus, 54  
   viridis, 54  
 Anabasis, 50  
   setifera, 50  
 Anagallis, 168  
   arvensis, 169  
   *latifolia*, 169  
   pumila, 169  
 Anastatica, 152  
   hierochuntica, 152  
 Arabidopsis, 160  
   pumila, 160  
 arad, 49  
 arat, 49  
 Arenaria, 72-73  
   *bocconii*, 72  
   *diantra*, 73  
   *foliacea*, 75  
   *glutinosa*, 74  
   *hybrida*, 73  
   leptocladus, 75  
   *rubra*, 73  
     var. *marina*, 73  
   *serpyllifolia*, 75  
     var. *leptoclados*, 75  
 Argemone, 17  
   mexicana, 17  
 Aristolochia, 12  
   *bracteata*, 12  
   bracteolata, 12  
 Aristolochiaceae, 11  
 arta, 84, 85  
 Arthrocnemum, 42, 43  
   *glaucum*, 43  
   *glaucum*, 43  
   macrostachyum, 42, 43  
 aselib, 134  
 ash bench, 161  
 aslub, 134  
 asmat, 162, 163  
 athel, 120-122  
 Atriplex, 39  
   farinosa, 39  
   griffithii, 39  
     subsp. *stocksii*, 39  
     var. *stocksii*, 39  
   halimus, 40  
   hastata, 39  
   *inamoena*, 40  
   leucoclada, 40  
     var. *inamoena*, 40  
   *sokotranum*, 39  
   stocksii, 39  
 ayn al qat, 169  
 aynah, 169  
 aytif, 31

### B

baklah, 59



baobab, 99  
 barbir, 59  
 Bassia, 41  
     *muricata*, 41  
 battikh, 125  
 bawiw, 156  
 bench, 121  
 Berberidaceae, 14  
 Berberis, 15  
     *baluchistanica*, 15  
     *holstii*, 15  
 Beta, 38  
     *maritima*, 38  
     *vulgaris*, 38  
         subsp. *maritima*, 38  
 Boerhavia, 29  
     *ascendens*, 29  
     *boissieri*, 31  
     *coccinea*, 29  
     *diffusa*, 29  
     *elegans*, 30  
         subsp. *stenophylla*, 30  
         var. *stenophylla*, 30  
     *helenae*, 31  
     *repens*, 29  
         var. *diffusa*, 29  
         var. *elegans*, 30  
         var. *viscosa*, 29  
     *rubicunda*, 30  
         subsp. *stenophylla*, 30  
     *stenocarpa*, 31  
 bols, 22  
 Bombacaceae, 99  
 Boscia, 132  
     *arabica*, 132  
 Brassica, 145  
     *arabica*, 145  
     *junceae*, 145  
     *oleracea*, 145  
     *rapa*, 145  
     *schimperii*, 145  
     *sinaica*, 150  
     *tournefortii*, 145  
*Brotera ovata*, 96  
*Bryonia*, 123  
     *cordifolia*, 128  
     *epigaea*, 123  
     *palmata*, 128  
*Butas spinosa*, 149  
 but, 167

## C

Cadaba, 132  
     *baccarinii*, 133  
     *farinosa*, 133  
     *heterotricha*, 132  
*Caidbeja adhaerens*, 27  
 Calligonum, 83  
     *arabicum*, 84  
     *comosum*, 84  
     *crinitum*, 84  
         subsp. *arabicum*, 84  
     *polygonoides*, 84  
         subsp. *comosum*, 84  
     *tetrapterum*, 85  
 Capparaceae, 130  
 Capparis, 131, 133  
     *aphylla*, 133  
     *cartilaginea*, 134  
     *decidua*, 133  
     *lencophylla*, 134  
     *mucronifolia*, 134  
     *spinosa*, 134  
         var. *aegyptia*, 134  
 Capsella, 152  
     *bursa-pastoris*, 152  
 Cardaria, 152  
     *draba*, 152  
*Carica papaya*, 171  
 Caricaceae, 171  
*Caroxylon*, 50  
     *bottae*, 50  
     *imbricatum*, 49  
     *salicornicum*, 46  
 Caryophyllaceae, 63  
*Casuarina equisetifolia*, 171  
 Casuarinaceae, 171  
*Cebatha pendula*, 16  
*Ceiba pentandra*, 100  
 Celosia, 52  
     *argentea*, 52  
     *trigyna*, 52  
         var. *fasciculiflora*, 52  
 Celtis orientalis, 19  
 Ceratophyllaceae, 12  
 Ceratophyllum, 12  
     *demersum*, 12  
*Chadara tenax*, 92  
*Cheiranthus linearis*, 155  
 Chenopodiaceae, 36

*Chenopodium*, 37  
     *aegyptiacum*, 43  
     *album*, 37  
     *baryosmon*, 49  
     *caudatum*, 54  
     *murale*, 38  
     *vulvaria*, 38  
*Chlorophytum nodiflorum*, 35  
 Cienfuegosia, 107  
     *welshii*, 107  
 Cistaceae, 116  
*Cistus*, 116  
     *lippii*, 116  
     *salicifolius*, 116  
     *stipulatus*, 117  
         var. *B*, 117  
 Citrullus, 127  
     *colocynthis*, 127  
     *lanatus*, 128  
 Clematis, 13  
     *orientalis*, 13  
 Cleome, 135  
     *albescens*, 139  
         subsp. *omanensis*, 139  
     *amblyocarpa*, 137  
     *austroarabica*, 138  
         subp. *muscatensis*, 138  
     *brachycarpa*, 136  
     *brevipetiolata*, 137  
     *drepanocarpa*, 138  
     *glaucescens*, 139  
     *gracilis*, 136  
     *gynandra*, 140  
     *noeana*, 138  
     *oxypetala*, 139  
         var. *micrantha*, 139  
     *pentabylla*, 140  
     *rupicola*, 139  
     *scaposa*, 136  
 Clypeola, 157  
     *aspera*, 157  
     *jonthlaspi*, 157  
 Cocculus, 16  
     *balfourii*, 16  
     *leacha*, 16  
     *pendulus*, 16  
 Cometes, 64  
     *abyssinica*, 65  
     *surattensis*, 64

- Commicarpus*, 30  
     *boissieri*, 31  
     *helenae*, 31  
     *mistus*, 32  
     *squarrosus*, 32  
     *stenocarpus*, 31  
*Corallocarpus*, 123  
     *epigaeus*, 123  
     *glomeruliflorus*, 124  
*Corbichonia*, 33  
     *decumbens*, 33  
*Corchorus*, 93  
     *aestuas*, 94  
     *antichorus*, 93  
     *depressus*, 93  
     *olitorius*, 94  
     *prostratus*, 93  
     *trilocularis*, 94  
*Cornulaca*, 45  
     *arabica*, 46  
     *aucherii*, 45  
     *leucacantha*, 45  
     *monacantha*, 46  
*Coronopus*, 151  
     *didymus*, 151  
*Corrigiola repens*, 69  
*Cruciferae*, 141  
*Cucumis*, 125  
     *acutangla*, 129  
     *canoxyi*, 127  
     *colocynthis*, 127  
     *fiqareh*, 126  
     *maderaspataana*, 128  
     *mascatensis*, 126  
     *melo*, 125  
         subsp. *agrestis*, 125  
     *prophetarum*, 126  
         subsp. *dissectus*, 127  
         subsp. *prophetarum*, 126  
     *pustulatus*, 126  
     *sativus*, 125  
*Cucurbitaceae*, 123  
*Culhamia hadramensis*, 99  
**D**  
*dad*, 53  
*dakar*, 84, 85  
*Delphinium penicellatum*, 14  
     *derfi*, 24  
*Dhofaria*, 135  
     *macleishii*, 135  
*Dianthus*, 79  
     *crinitus*, 79  
         var. *crossopetalus*, 79  
     *cyri*, 79  
*Digera*, 55  
     *arvensis*, 55  
     *muricata*, 55  
*dinaban*, 165  
*Dionysia*, 170  
     *mira*, 170  
*Diploscyos*, 128  
     *palmatus*, 128  
*Diplotaxis*, 146  
     *acris*, 147  
     *harra*, 146  
*Dipterygium*, 140  
     *glaucum*, 140  
         var. *macrocarpa*, 140  
*diqam*, 23  
*dorbaih*, 38  
*Dorstenia*, 20  
     *arabica*, 20  
     *foetida*, 20  
         var. *obovata*, 21  
     *radiata*, 20  
         var. *foetida*, 20  
*Draba verna*, 156  
*Dyerophytum*, 90  
     *indicum*, 90  
**E**  
*Ebenaceae*, 167  
*Edgeworthia buxifolia*, 167  
*ethe*, 56  
*ejesebeh*, 87  
*ekthoreh*, 99  
*ektoreh*, 99  
*elki'in*, 86  
*elos*, 22  
*elsi'in*, 86  
*Emex*, 83  
     *spinosa*, 83  
*emloh*, 90  
*enkhije*, 99  
*enkhize*, 99  
*enqi'in*, 86  
*ensa'un*, 86  
*Eremobium*, 159  
     *aegyptiacum*, 159  
     *linearis*, 159  
*Erophila*, 156  
     *verna*, 156  
*Eruca*, 147  
     *lativalvis*, 147  
     *sativa*, 147  
*Erucaria*, 148  
     *hispanica*, 148  
     sp. A, 148  
*Erucastrum*, 145  
     *arabicum*, 145  
*esten*, 16  
*ette*, 56  
*Euclea*, 168  
     *racemosa*, 168  
         subsp. *schimperii*, 168  
     *schimperii*, 168  
**F**  
*fafy*, 171  
*farfina*, 60  
*Farsetia*, 153  
     *aegyptia*, 153  
     *arabica*, 155  
     *dhofarica*, 156  
     *hamiltonii*, 154  
     *heliophila*, 155  
     *latifolia*, 154  
     *linearis*, 155  
     *longisiliqua*, 155  
     *oralis*, 153  
     *prostrata*, 154  
     *ramosissima*, 154  
     *stylosa*, 154, 155  
*fehawen*, 56  
*fejel*, 148  
*feqawz*, 125  
*thiw*, 56  
*Ficus*, 21  
     *carica*, 22  
     *cordata*, 24  
         subsp. *salicifolia*, 24  
     *geraniifolia*, 23  
     *ingens*, 24  
     *morifolia*, 22

palmata, 22  
     subsp. palmata, 22  
*persica*, 23  
*salicifolia*, 24  
*socotrana*, 24  
*sycomorus*, 23  
 vasta, 24  
*Fioria vitifolia*, 103  
*Forsskaolea*, 27  
     *tenacissima*, 27  
     *viridis*, 28  
*Frankenia*, 122  
     *pulverulenta*, 122  
*Frankeniaceae*, 122  
*Fumaria*, 19  
     *abyssinica*, 19  
*Fumariaceae*, 18

## G

gared, 91  
 gesib, 87  
 gesob, 87  
 ghadrect, 17  
 ghagha, 12  
 gharaiz(ah), 42  
 ghared, 91  
 gharegha, 154  
 ghashar, 146  
 ghashor, 146  
 gheydeh, 23  
 gheyzeh, 23  
 ghizit, 23  
 ghozel, 107  
*Gisekia*, 28  
     *pharnaceoides*, 28  
 gizhah, 69  
*Glinus*, 35, 62  
     *chrySTALLINUS*, 35  
     *lotoides*, 62  
*Glossostemon*, 98  
     *bruguieri*, 98  
*Gossypium*, 107  
     *herbaceum*, 108  
     *hirsutum*, 108  
     *stocksii*, 107  
*Grewia*, 91  
     *bicolor*, 91  
     *damine*, 91  
     *erythraea*, 91

*populifolia*, 92  
     *tenax*, 91, 92  
         subsp. *makaranika*, 91  
         var. *erythraea*, 91  
     *villosa*, 93  
*gursut*, 163  
*Gymnocarpus*, 65  
     *decandrus*, 65  
         f. *salsoloides*, 65  
     *dhofarensis*, 66  
     *rotundifolius*, 66  
*Gynandropsis*  
     *gynandra*, 140  
     *pentaphylla*, 140  
*Gypsophila*, 78  
     *bellidifolia*, 78  
     *montana*, 78

## H

hab al 'ajaiz, 55  
 hadat al wa'al, 64  
 hadh, 46  
 hadimdam, 29, 30  
 hafrah, 158  
 hal al shu, 161  
*Halocnemum*, 42  
     *strobilaceum*, 42  
*Halopeplis*, 42  
     *perfoliata*, 42  
*Halothamnus*, 50  
     *bottae*, 50  
*Haloxylon*, 46  
     *salicornicum*, 46  
 hamdeh, 44, 59  
 hamid, 81  
*Hammada*, 46  
     *elegans*, 46  
     *salicornica*, 46  
 hamzut, 59  
 hanayzal, 126  
 hanzal, 126, 127  
 harm, 43, 44  
 haselib, 134  
 haselot, 134  
 hashan, 154  
 hashwey, 125  
 hath, 46  
 hatif, 31  
 hegimt, 167

*Helianthemum*, 116  
     *citrinum*, 117  
     *kahiricum*, 117  
     *lippii*, 116  
     *salicifolium*, 116  
     *stipulatum*, 117  
*Hermannia*, 97  
     *paniculata*, 97  
     *testacea*, 98  
*Herniaria*, 68  
     *hirsuta*, 68  
     *maskatensis*, 68  
*herum dhezen*, 86  
*herum chot*, 123  
*herum idheri*, 135  
*hesli*, 45  
*Hesperis africana*, 159  
*hibab*, 162  
*hibab kib*, 163  
*hibab masharri*, 153  
*Hibiscus*, 101, 116  
     *esculentus*, 105  
     *micranthus*, 104  
     *ovalifolius*, 104  
     *palmatus*, 103  
     *seindicus*, 104  
     *sidiformis*, 102  
     *somalensis*, 103  
     sp. A, 105  
     sp. B, 105  
     *spartioides*, 104  
     *trionum*, 102  
     *vitifolius*, 103  
     *welshii*, 107  
*Hibiscus rosa-sinensis*, 116  
*Hollyhock*, 115  
*Holosteum*, 74  
     *glutinosum*, 74  
     *umbellatum*, 74  
         var. *glutinosum*, 74  
*Homalodiscus aucheri*, 164  
*hotibib*, 24  
*howteb*, 43  
*Hybanthus*, 119  
     *durus*, 119  
*Hyperanthera peregrina*, 161

## I

*ibleh*, 84



Indian cherry tree, 171

*Iresine javanica*, 56

isi, 129

isqab, 22

itebeh, 24

itif, 31

itseni, 123

## J

jibun, 107

Juglandaceae, 171

*Juglans regia*, 171

## K

kartib, 20

*Kedrostis glomeruliflora*, 124

ketil dhorin, 86

kertib, 20

khadiraf, 49

khatij, 149

kharazah, 42

khardal, 146

kharterit, 97

khawfig, 149

khawfij, 149

khawshyan, 146

khaymaran, 13

kheryvsha, 152

kherutret, 97

kheyar, 125

khi, 93

khigar, 125

khori, 93

khumkham, 48

kibdenit, 68

kiff al adhira, 152

kiff e Maryam, 152

kilit, 168

klmite, 93

*Kochia muricata*, 41

## L

*Laportea*, 26

interrupta, 26

lasaf, 134

lazaq, 27

*Leachia*, 16

*Lepidium*, 150

aucherii, 150

*didymum*, 151

*draba*, 152

sativum, 151

lezaf, 134

*Limeum*, 61

arabicum, 61

kibdenit, 62

obovatum, 62

*Limonium*, 86

axillare, 87

carnosum, 89

milleri, 89

pruinatum, 90

sarcophyllum, 88

stocksii, 87

lisaf, 134

lisan al kalb, 83

lithab, 24

lizaygah, 27

loiya, 12

lozet, 134

lufa, 129

*Luffa*, 129

acutangula, 129

*Lunaria*

parviflora, 150

scarbra, 153

## M

*Maerua*, 131

arabica, 131

crassifolia, 131

oblongifolia, 131

uniflora, 131

maharraqa, 160

*Malcomia*, 159

aegyptiaca, 159

africana, 159

*Malva*, 110

coromandeliana, 113

neglecta, 110

parviflora, 110

Malvaceae, 100

*Malvastrum*, 113

coromandelianum, 113

malzaq, 27

matabiqah, 27

*Melhania*, 96

abyssinica, 96

ovata, 96

var. abyssinica, 96

phillipsiae, 97

melheloh, 90

mellah, 90

*Melochia cordata*, 114

Menispermaceae, 15

*Mesembryanthemum*, 35

nodiflorum, 35

mesogh, 55

*Minuartia*, 73

hybrida, 73

meyeri, 74

misi, 129

Molluginaceae, 61

*Mollugo*, 62

cerviana, 62

glinus, 62

lotoides, 62

tetraphylla, 71

*Momordica charantia*, 129

*Monotheca*, 166

mascataensis, 167

Moraceae, 20

*Morettia*, 158

asperrima, 158

parviflora, 158

philacana, 158

*Moricandia*, 150

sinaica, 150

*Moringa*, 161

aptera, 161

oleifera, 161

peregrina, 161

Moringaceae, 161

*Morus*, 25

alba, 25

nigra, 25

*Mukia*, 128

maderaspata, 128

munaqah, 111

munaqqah, 111

*Muntingia calabura*, 171

Muntingiaceae, 171

muqabil as shams, 139

## N

na'ina, 19

naksh, 171

naqawa, 50  
 nijlah, 59  
 nishtayn, 16  
 Notoceras, 157  
     bicorne, 157  
     canariensis, 157  
 Nyctaginaceae, 29

## O

Ochradenus, 162  
     arabicus, 163  
     aucheri, 164  
     baccatus, 162  
         var. *monstruosa*, 162  
         var. *scandens*, 162  
     gifrii, 163  
     harsusiticus, 163  
 Oligomeris, 164  
     linifolia, 164  
     subulata, 164  
 Orygia  
     *decumbens*, 33  
     *portulacifolium*, 59  
 osor, 107  
 osot eshekherit, 60  
 Ouret, 56

## P

Papaver, 17  
     decaisnei, 18  
     dubium, 18  
         var. *laevigatum*, 18  
     *lacrugatum*, 18  
 Papaveraceae, 17  
 Parietaria, 27  
     alsinifolia, 27  
     luisitanica, 27  
 Paronychia, 65, 67  
     arabica, 67  
     *decandra*, 65  
     *sclerocephala*, 67  
 Pavonia, 108  
     arabica, 108  
     cristata, 109  
     glechomifolia, 108  
     pirottiae, 109  
     schweinfurthii, 109  
 pawpaw, 171

Peperomia, 11  
     pellucida, 11  
*Persicaria glabra*, 81  
*Pharnaceum*, 62  
     *cervianum*, 62  
     *occultum*, 28  
     *umbellatum*, 62  
*Phialocarpus glomeruliflorus*,  
 124  
 Physorhynchus, 149  
     chamaerapistrum, 149  
 Phytolaccaceae, 28  
 Pilea, 26  
     *quadrifolia*, 26  
     tetraphylla, 26  
*Piper pellucidum*, 11  
 Piperaceae, 11  
 Plumbaginaceae, 85  
 Plumbago, 86  
     zeylanica, 86  
 Polycarpaea, 68  
     jazirensis, 70  
     repens, 69  
     robbairea, 70  
     spicata, 69  
 Polycarpon, 70  
     *robbairea*, 70  
     succulentum, 71  
     tetraphyllum, 71  
 Polygonaceae, 80  
 Polygonum, 81  
     glabrum, 81  
 Portulaca, 59  
     dhofarica, 60  
     oleracea, 59  
     quadrifida, 60  
 Portulacaceae, 58  
*Primula aucheri*, 170  
     shajrat al wa'al, 170  
 Primulaceae, 168  
 Psilotrichum, 57  
     virgatum, 57  
 Pteropyrum, 85  
     scoparium, 85  
*Pupal*, 55  
 Pupalia, 55  
     lappacea, 55  
         var. *velutina*, 55  
     *velutina*, 55

## Q

qanfar, 134  
 qataf, 87  
 qatn, 107  
 qerzeb, 43  
 qerzot, 43  
 qilit, 168  
 qomsheli, 86  
 quttaif(ah), 53  
 quttn, 107

## R

ra, 56  
 raghawa, 64  
 rahad, 159  
 ramt, 87  
 Ranunculaceae, 13  
 Ranunculus, 14  
     muricatus, 14  
 Raphanus, 147  
     raphanistrum, 148  
     sativus, 148  
 rashad, 151  
 remth, 46  
*Reptonia buxifolia*, 167  
 Reseda, 164, 165  
     aucheri, 165  
         var. *bracteata*, 165  
     *bracteata*, 165  
     *linifolia*, 164  
     muricata, 165  
     sphenocleoides, 166  
 Resedaceae, 162  
 riglah, 59  
 rimth, 46  
 rishad, 151  
*Robbairea*, 70  
     *delileana*, 70  
     *prostrata*, 70  
 Rose of Jericho, 152  
 Rumex, 81  
     conglomeratus, 82  
     dentatus, 83  
     limoniastrium, 82  
     *spinosus*, 83  
     vesicarius, 81

## S

sa'ar al 'yuz, 60

- sahr, 131  
 Salicaceae, 129  
*Salicornia*, 42  
   *macrostachya*, 43  
   *perfoliata*, 42  
   *strobilacea*, 42  
 Salix, 129  
   *acmophylla*, 129  
   *persica*, 129  
 Salsola, 41, 47  
   *baryosma*, 49  
   *bottae*, 50  
   *cyclophylla*, 48  
   *drummondii*, 47  
   *badramautica*, 48  
   *imbricata*, 49  
   *leucophylla*, 48  
   *muricata*, 41  
   *obpyrifolia*, 47  
   *omanensis*, 48  
   *rubescens*, 48  
   *schweinfurthii*, 47  
   *spinescens*, 49  
 Samolus, 169  
   *valerandi*, 169  
 Saponaria  
   *barbata*, 78  
   *montana*, 78  
 Sapotaceae, 166  
 Savignya, 150  
   *aegyptiaca*, 150  
   *parviflora*, 150  
 sawja, 129  
 sawjar, 129  
 sawmar, 16  
 sawqam, 23  
*Schanginia*, 43  
   *aegyptiaca*, 43  
   *baccata*, 43  
   *hortensis*, 43  
 Sclerocephalus, 67  
   *arabicus*, 67  
 sefeq, 86  
 sefiqet, 86  
*Seidlitzia lanigera*, 50  
 seluntah, 93  
 semerah, 105, 106  
 Senra, 106  
   *incana*, 106  
 ses'onte, 86  
 Sevada, 50  
   *schimperii*, 50  
 shahmat ad dab, 93  
 shajarat al wa'al, 170  
 shajaret al Maryam, 152  
 shakhas, 163  
 sharham, 91  
 shegra al santen, 53  
 sherham, 91  
 shiltat, 159  
 shisyit, 87  
 shu, 161  
 shuwayb al hammam, 113  
 Sida, 111, 114  
   *bidentata*, 112  
   *cordata*, 114  
   *hirta*, 112  
   *indica*, 113  
   *mauritiana*, 111  
   *ovata*, 115  
   *pannosa*, 112  
   *spinosa*, 114  
   *urens*, 115  
   *veronicifolia*, 114  
 sidaf, 85  
 Sideroxylon, 166  
   *buxifolium*, 167  
   *mascatense*, 167  
   *mascatensis*, 167  
 Silene, 76  
   *apetala*, 76  
   *austroiranica*, 77  
   *burchellii*, 78  
   *conoidea*, 76  
   *flammulifolia*, 78  
   *linearis*, 77  
   *schweinfurthii*, 77  
   *villosa*, 77  
 silih, 46  
 simer, 132, 133  
 Sinapis, 145, 146  
   *arvensis*, 146  
   *harra*, 146  
   *hispanica*, 148  
   *juncea*, 145  
   *philacana*, 158  
 sindar, 53  
 siqab, 22  
 sir, 132  
 sisyt, 87  
 Sisymbrium, 159  
   *erysimoides*, 160  
   *irio*, 159  
*Sodada decidua*, 133  
 sojar, 129  
 sowad, 44, 45  
 sowaid, 44, 45  
 Spergula, 72  
   *fallax*, 72  
     var. *pentandra*, 72  
 Spergularia, 72  
   *bocconii*, 72  
   *diandra*, 73  
   *fallax*, 72  
   *marina*, 73  
 Sphaerocoma, 66  
   *aucheri*, 66  
*Spiniluma*, 166  
*Statice*, 86  
   *arabicum*, 87  
   *axillaris*, 87  
   *carnosum*, 89  
   *stocksii*, 87  
 Stellaria, 75  
   *media*, 75  
 Sterculia, 98  
   *africana*, 99  
   *arabica*, 99  
 Sterculiaceae, 95  
*Strigosella africana*, 159  
 Suaeda, 43  
   *baccata*, 43  
   *fruticosa*, 44  
   *hortensis*, 43  
   *monoica*, 44  
   *moschata*, 45  
   *paulayana*, 44  
   *schimperii*, 50  
   *vermiculata*, 44, 50  
   *volkensii*, 44  
 sulaykit mal jebel, 30  
 sunajid, 29  
 sunayid, 29  
 T  
 Talinum, 59  
   *portulacifolium*, 59  
 Tamaricaceae, 120



Tamarix, 120  
     *arabica*, 120  
     *articulata*, 121  
     *aucheriana*, 122  
     *mascatensis*, 120  
     *orientalis*, 121  
     *passerinoides*, 122  
     *stricta*, 121  
 tashmezg, 17  
 tayq, 24  
 teb, 43  
 tehamah, 87  
 temteli, 53  
 temtelig, 53  
 terfal, 121, 161  
 thiqab, 22  
*Thuja aphylla*, 121  
 Tiliaceae, 90  
 tin, 22  
 tiq, 24  
 Trema, 19  
     *guineensis*, 19  
     var. *hochstetteri*, 19  
     *orientalis*, 19  
 Trianthema, 33  
     *monogyna*, 33

*pentandra*, 34  
     *portulacastrum*, 33  
     *triquetra*, 34  
*Trichaurus aucherianus*, 122  
*Triphaca africana*, 99  
 Triumphetta, 95  
     *pentandra*, 95  
     sp. A, 95  
 tubaq, 27  
 tubayq, 27  
 tut, 25

## U

Ulmaceae, 19  
*Urtica tetraphylla*, 26  
 Urticaceae, 25

## V

Viola, 118  
     *cinerea*, 118  
         var. *cinerea*, 119  
         var. *stocksii*, 119  
     *somalensis*, 119  
     *stocksii*, 119  
 Violaceae, 118

*Vogelia*, 90  
     *arabica*, 90  
     *indica*, 90

## X

Xerotia, 70  
     *arabica*, 70

## Y

yawtin, 77  
 yen, 161

## Z

Zaleya, 34  
     *pentandra*, 34  
 Zehneria, 124  
     *anomala*, 124  
 zerkah, 169  
 zerkhis, 59, 60  
 Zilla, 149  
     *chamaerapistrum*, 149  
     *spinosa*, 149  
 zinban, 165  
 zirfit, 24  
 zkhanitte, 91  
 zorbah, 38  
 zraig al 'ayn, 169





S.A.  
Ghazanfar

FLORA OF THE  
SULTANATE OF OMAN  
Volume 1  
Piperaceae - Primulaceae



This is the first of four volumes of the *Flora of the Sultanate of Oman*. It includes 42 families of flowering plants, and describes 310 species in 155 genera. In the treatment of each family, keys are provided to genera as well as to all species within a genus. Species descriptions are concise and include notes on distribution, habitat, flowering and fruiting times, conservation status, and uses. Relevant synonyms and vernacular names, where known, are given. Distribution maps are provided for all described species. Key references and a selected bibliography of the vegetation and biogeography of Oman are included. Colour photographs of most of the species in this volume have been scanned and prepared as an interactive CD to accompany the text.



Shahina A. Ghazanfar has lived, worked and traveled in Oman, Pakistan and Nigeria, and has made major contributions to the study of the vegetation and flora of these countries. She has a particular interest in the conservation of the flora and the vegetation and biogeography of Oman and Arabia, where she has carried out extensive fieldwork. Her interests extend to the study of medicinal plants and traditional medicine of Arabia and South-West Asia. Shahina Ghazanfar studied at the University of Punjab, Pakistan, and University of Cambridge, UK, and is currently working at the Royal Botanic Gardens, Kew, UK, on the *Flora of Tropical East Africa*.

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